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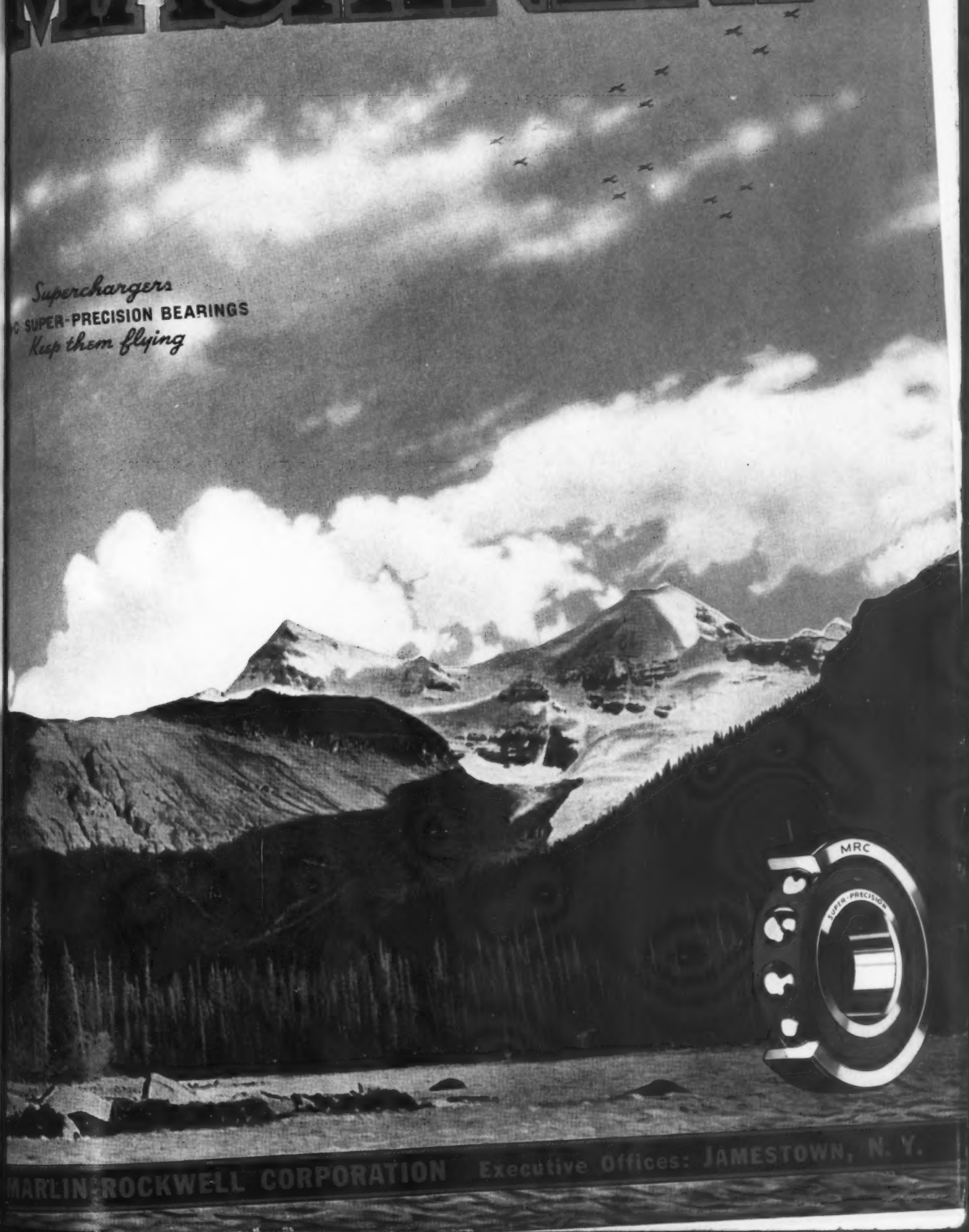

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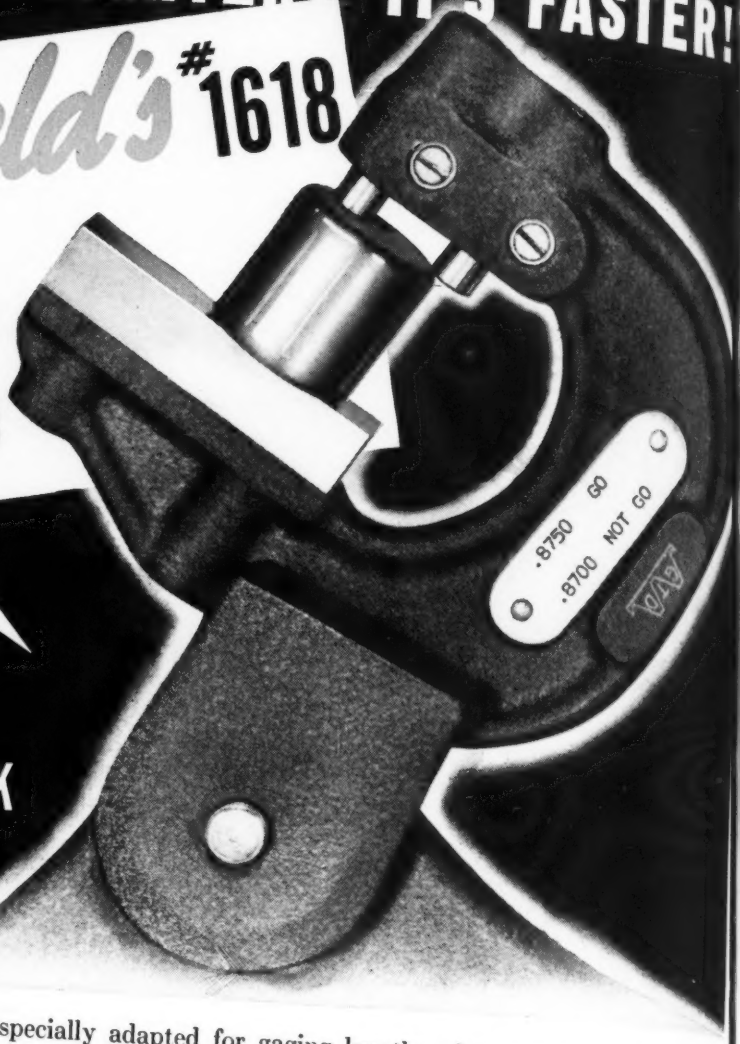

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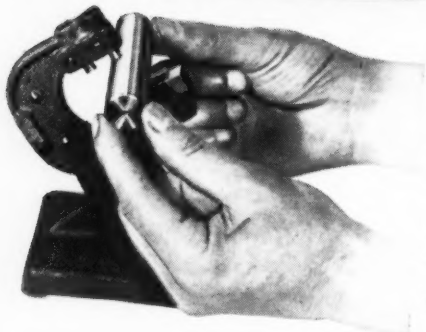

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MACHINERY

OCTOBER, 1943

Navy activities in time of war consist of more than winning glorious victories at sea—behind our fleets are the Navy Yards, which keep the ships in fighting trim and build new men-of-war to increase our fighting strength. Private shipyards, too, and industrial plants have an important part in constructing new ships, building the propulsion equipment, and producing the navigation instruments. November MACHINERY will describe the methods and equipment used for these purposes. An introductory article by the Admiral who is Chief of the Bureau of Ships will outline shipyard production for the United States Navy in this war.

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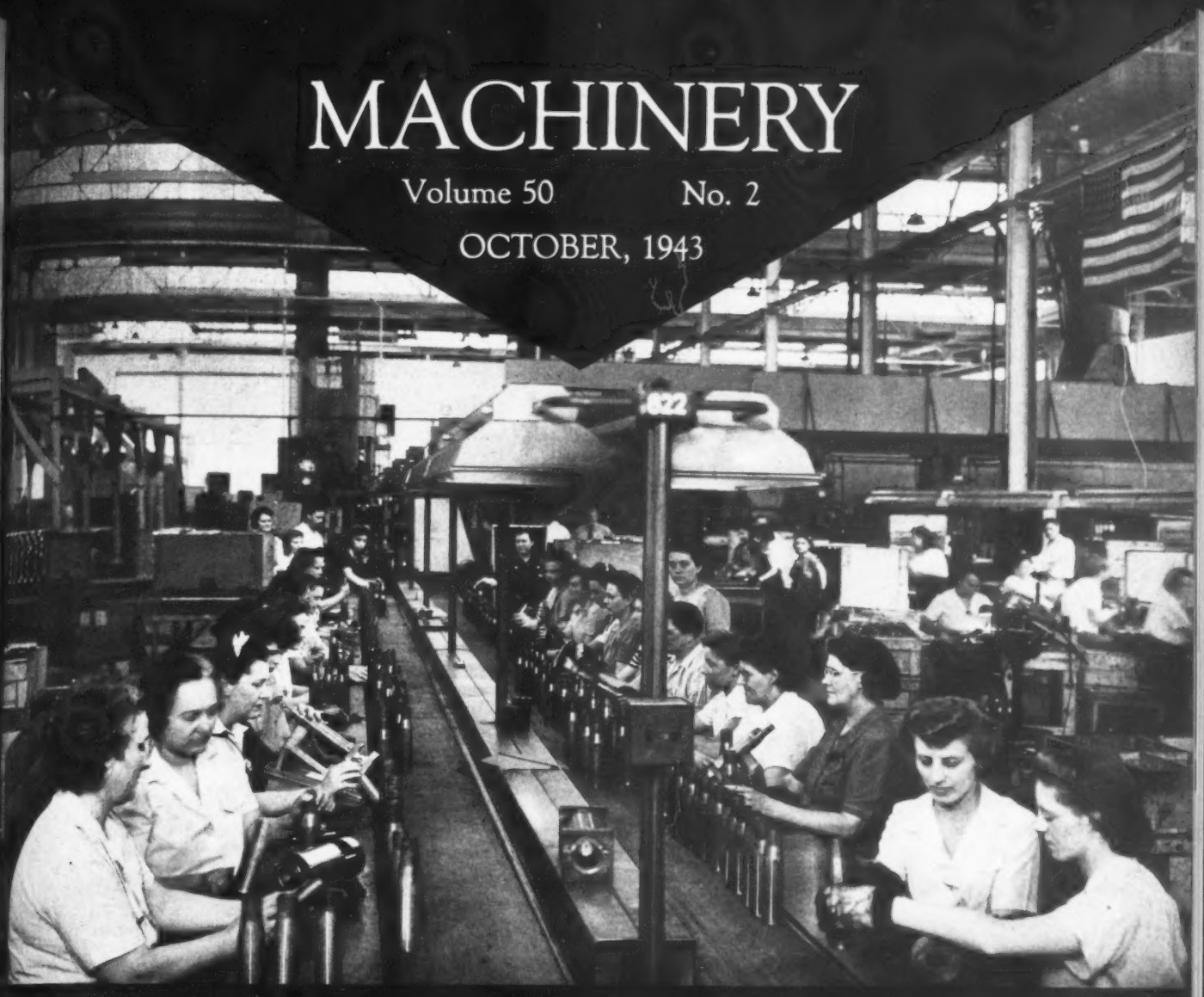


Steel Cartridge Cases from a Chase Brass Plant

By CHARLES O. HERB

UP until the present war, cartridge cases of all sizes were made exclusively from brass because that material possesses physical characteristics which make it exceptionally suitable for this application. In this war, however, the tremendous armament program and the isolation of some sources of supply caused a critical shortage of copper, which made it desirable to adopt some substitute for brass in cartridge-case manufacture. The Army Ordnance Department, therefore, called on industry to aid in developing methods of producing cartridge cases from steel.

A group of industrial concerns cooperated closely with the Ordnance Department in the research entailed in making such an important change in munitions manufacture. As a result of this pooling of manufacturing experience, satisfactory cartridge cases are today being produced from steel, although, of course, brass is still extensively used in making cartridge cases.

VICTORY

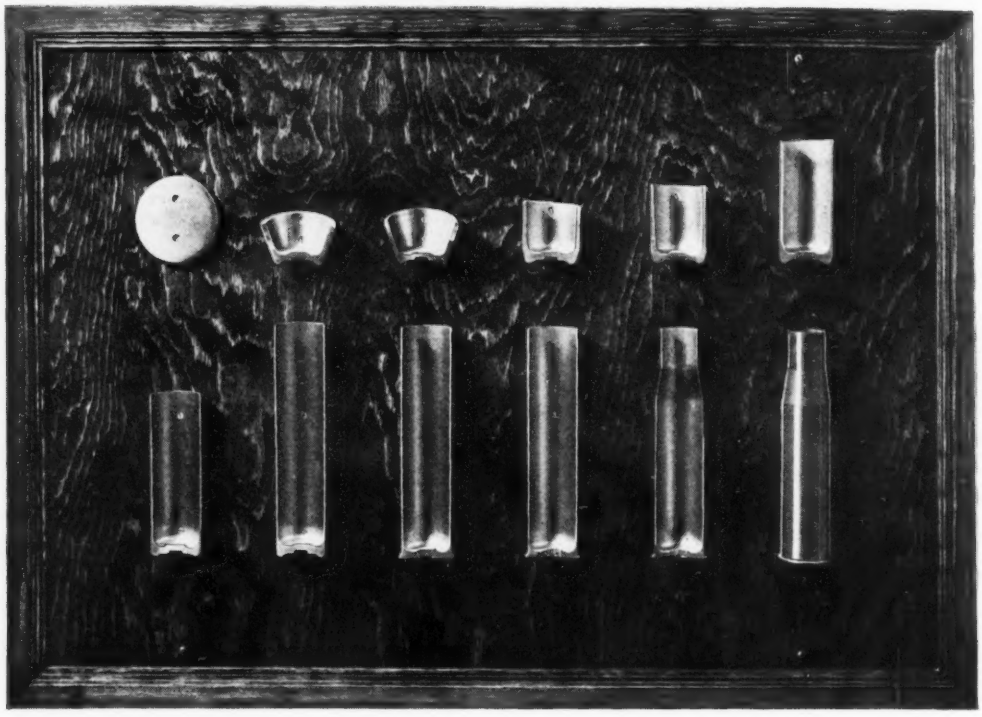
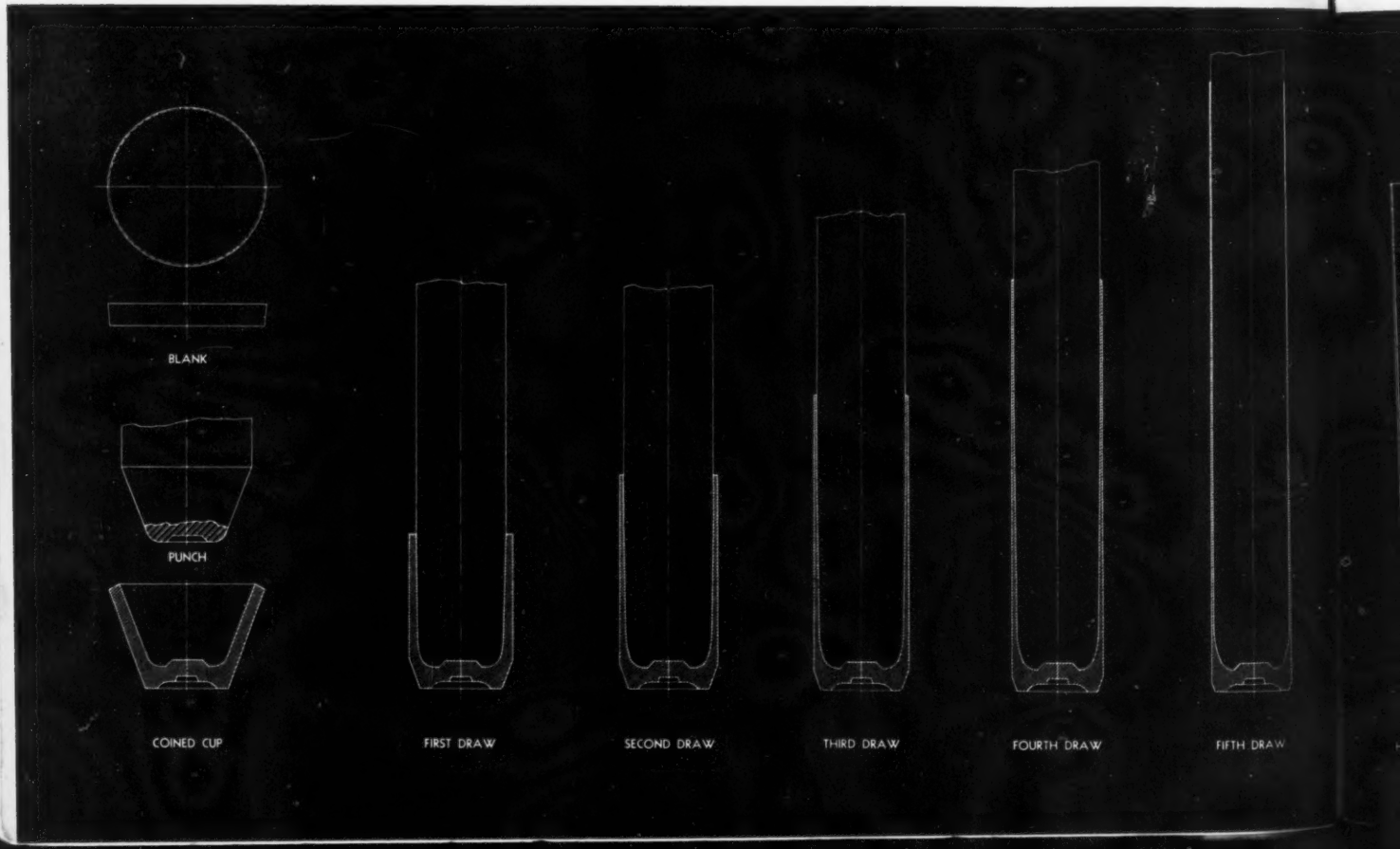


Fig. 1. Display Board Showing Cross-sections of 37-millimeter Steel Cartridge Cases in the Various Stages of Manufacture, together with a Disk from which the Case is Produced and a Finished Case

Fig. 2. Diagrams Indicating the Changes in the Appearance of 40-millimeter Steel Cartridge Cases with Each Machine Operation Performed in the Manufacture of These Cases

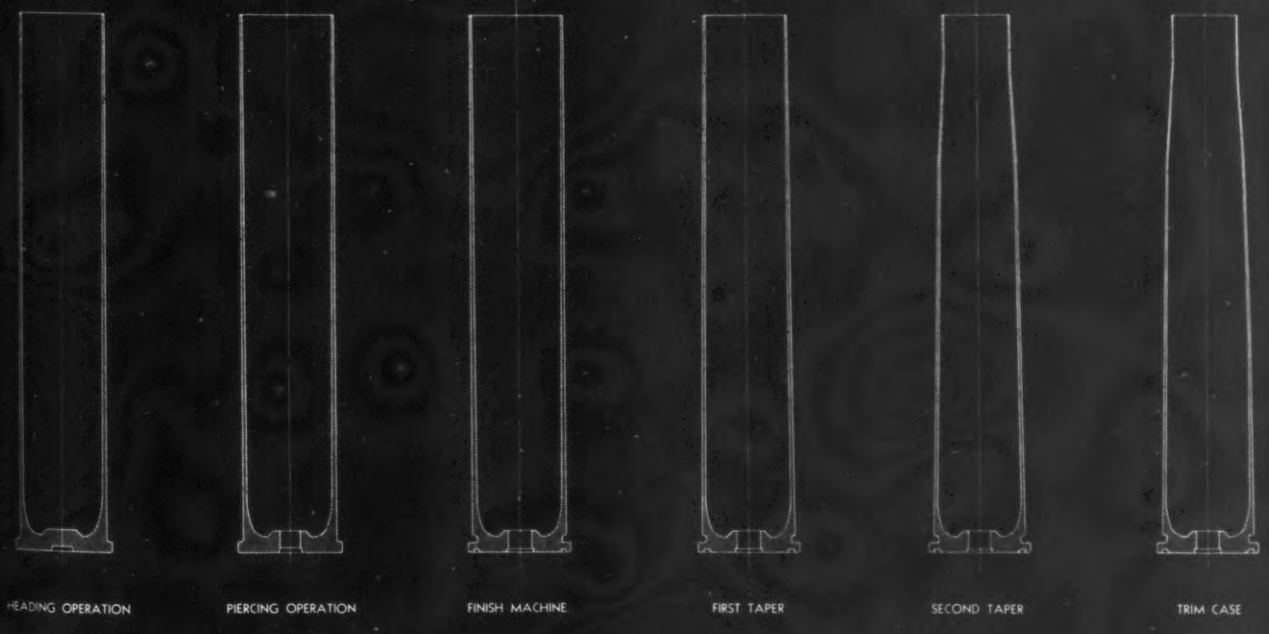


Many of the industrial concerns now engaged in steel cartridge-case manufacture were in a position to plan their cartridge-case shops from the "ground up" for the use of steel. However, the Chase Brass & Copper Co. was asked to convert a plant that had already been erected and was equipped specifically for making cartridge cases from brass. This factor introduced additional handicaps that other companies did not need to overcome. In this Chase plant, which is located at Euclid, Ohio, steel cartridge cases have been produced in 37-, 40-, 75-, and 105-millimeter sizes.

Before describing in detail the manufacturing processes followed in this plant, some of the physical properties required in cartridge cases will be pointed out. First of all, the wall of a cartridge case must be sufficiently elastic so that it will expand a certain amount when the shell is fired and provide a tight seal against the breech wall of the gun, in order to prevent the force of the explosion from being directed backward into the breech. The cartridge case must be fully supported along the breech wall or else a pressure is likely to develop between the breech and the case that is so great as to burst the case. At the same time, there must be enough clearance between the cartridge case and the breech wall to permit easy loading of the shell, and after the shell has been fired there must be sufficient clearance to allow the case to be readily ejected.

Thus, a cartridge case must possess enough elasticity to take up the clearance between it and the breech wall when the gun is discharged, and also enough to return to its original diameter immediately after the gun has been fired. Another important requisite is that high physical properties are demanded in the body of the cartridge case; for instance, the tensile strength at the head end must be between 106,000 and 112,000 pounds per square inch. The mouth, however, must be annealed to reduce the tensile strength to about 50,000 pounds per square inch, so as to insure the tight seal essential when the powder is exploded in the case.

Steel cartridge cases must possess a greater yield strength than brass cases, owing to the fact that steel has a modulus of elasticity of 30,000,000, as against 14,000,000 for brass. Steel presents the additional disadvantage of being subject to corrosion from atmospheric conditions, water, etc., and will throw off sparks under certain conditions, which may present a



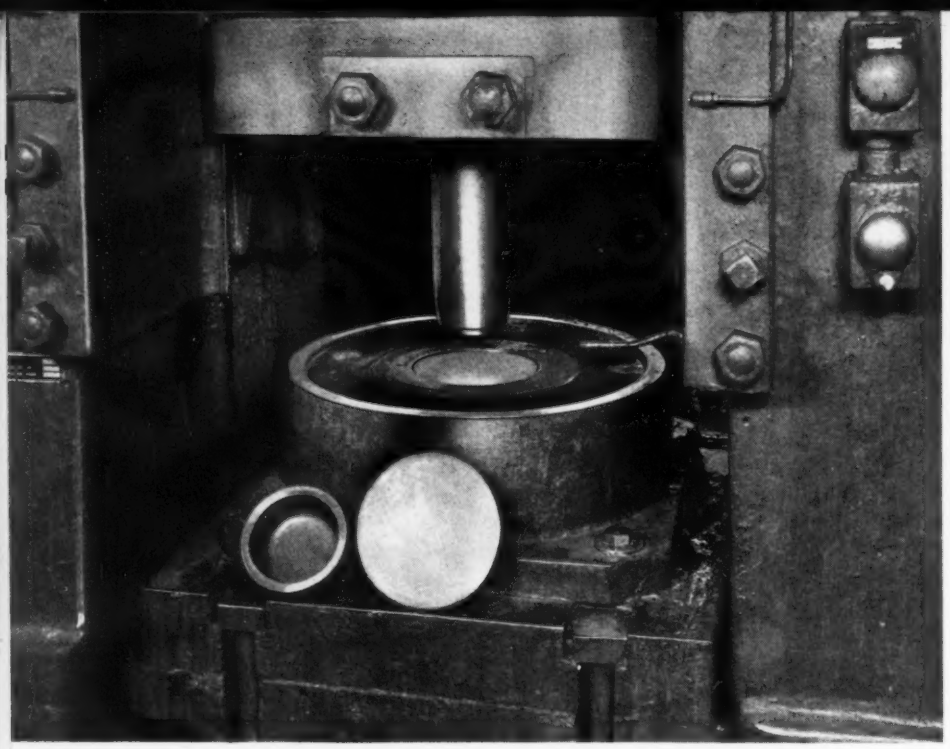


Fig. 3. Steel Cartridge Cases of the 75- and 105-millimeter Sizes are Cupped prior to a Coining Operation in Push-through Dies

hazard. Cartridge cases made from this material must, therefore, be given a coating of some sort to prevent either corrosion or sparking before being shipped from the manufacturing plant.

A final requirement is that steel cartridge cases must be interchangeable with brass cases, because both types may be used together on the battlefield in identical guns.

The principal differences between the manufacture of cartridge cases from brass and from steel naturally arise from the greater difficulty in working and machining steel. The wear on the punches and dies in drawing steels is far more severe, and for this reason the punches are generally plated with chromium, and the dies fitted with inserts of tungsten carbide. If this were not done, tool costs in drawing steel cartridge cases would be prohibitive, and a great amount of time would be consumed in changing tools. Similarly, tantalum-carbide cutters are used in the Chase plant for practically all machining cuts on the head end of the steel cartridge cases. These cases must be annealed after each drawing operation to make the material workable for the succeeding operation.

Difficulties also arise in steel cartridge-case production from minute particles of slag in the material. Because steel is produced in comparatively large quantities at a time, it is almost impossible to keep it as clean as brass. Any inclusions in the steel lead to a weakness which will cause failure in use; it is therefore imperative to keep a close check on the quality of steel used in cartridge-case manufacture.

The same dimensional tolerances are specified for steel cartridge cases as for brass—tolerances that are exceptionally close for steel drawing operations. For example, on 37-millimeter cartridge cases, the thickness of the wall at the mouth must be 0.030 inch, plus nothing, minus 0.006 inch. The diameter of the mouth after tapering must be 1.432 inches, plus nothing, minus 0.006 inch, while the diameter of the flange on the head end must be maintained within plus nothing, minus 0.002 inch. Greater difficulties are experienced in producing the larger sizes of cartridge cases than in making the smaller sizes. Further developments are in progress to obtain desired results, including heat-treating investigations directed toward the production of more uniform cases.

The cartridge cases are being produced in the Chase plant from carbon steel of S A E 1025 to 1030 specifications. The steel is received from the mill in the form of disks, sheared to the required diameter and with the edges cut to a slight angle. These blanks are coined into tapered cups with the closed end partially headed before drawing is started.

The forming of the coined cups, in the case of the 75- and 105-millimeter cartridge cases, is accomplished in two operations, which greatly reduces the pressure that must be applied in

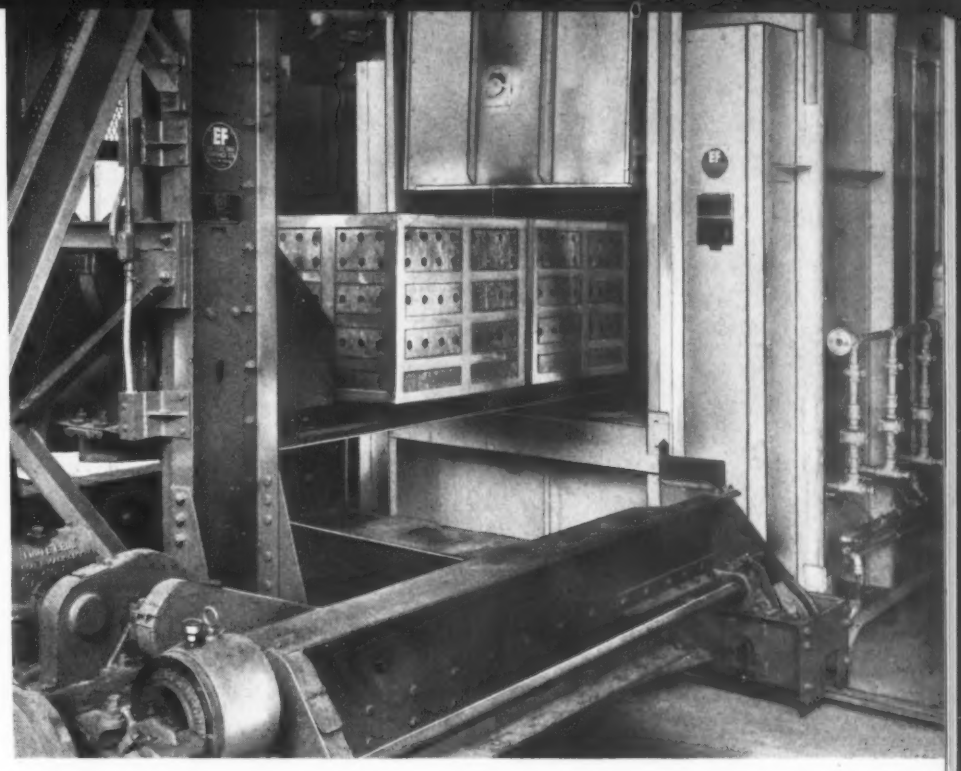


Fig. 4. Loading Baskets of Cartridge-case Cups into an Annealing Furnace with a Floor Crane after the Performance of a Press Operation

any one operation. This practice prolongs tool life appreciably. First, there is a preliminary forming or cupping operation in which the material is shaped into a simple cup. The steel is folded rather than drawn, as the thickness is not changed.

If cracks or other defects appear in the formed cups, they are immediately rejected, and work on defective material is therefore held to a minimum. After the cups are formed, they are annealed and then coined by the process to be described.

With cartridge cases of 37- and 40-millimeter sizes, the first operation consists of coining the blank disk into a cup of tapered shape, as seen on the display board in Fig. 1 at the right of the blank in the upper row. Larger cartridge cases are coined after having been cupped and annealed. The sequence of operations that change the appearance of 40-millimeter cases is indicated diagrammatically in Fig. 2.

Fig. 3 shows a Bliss power press set up for performing the cupping operation on blanks for 105-millimeter cases. The blank is 7 3/8 inches in diameter by 0.515 inch thick. It is formed into a cup of approximately 4 1/2 inches inside diameter by 2 inches in height as the punch forces the blank through the die. Prior to this operation, a paste lubricant is applied to the blanks. In addition, liquid lubricant is delivered to the die through the pipe extending from the housing on the right-hand side of the press.

As the cups are forced through the die they enter a chute constructed of small tubes, which leads to a belt conveyor at the rear of the machine. The cups automatically drop on this conveyor and are carried to steel annealing baskets into which they also fall automatically. As each annealing basket is filled it is transported by a power-driven chain conveyor to a point where it can be picked up by a large floor crane which serves a battery of annealing furnaces and cooling installations.

Fig. 4 shows this crane being used for charging several baskets of cups into one of the annealing furnaces. The baskets are supported on a boom or fork that can be moved up or down and advanced into the open furnaces, where the baskets are lowered on the hearth. They are kept in the annealing furnace for a period of 1 1/2 hours at a temperature of 1250 degrees F. All annealing furnaces in the plant are fired by natural gas. They are 10 feet deep. At the left in Fig. 5 is seen one of the chain conveyors that brings the basket of formed parts to the furnace crane.

When the cups have been annealed, they are taken from the furnace by the floor crane and transferred to a cooling unit large enough to receive two furnace loads of cartridge cases at one time. Fig. 5 shows a typical cooling unit and three baskets of annealed work being deposited on the loading table by a floor crane. The baskets of work are carried into the cooling

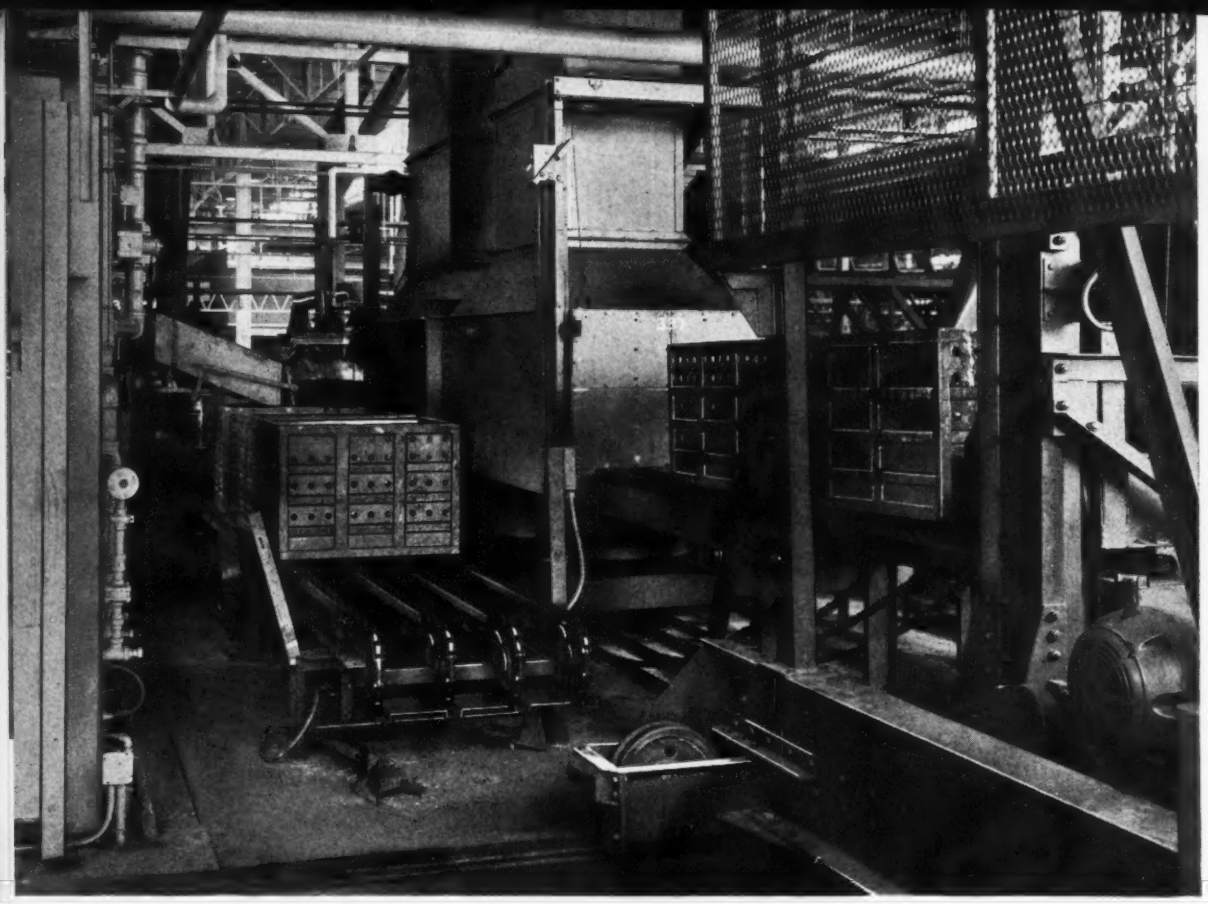


Fig. 5. After Each Annealing Operation, the Cartridge-case Cups are Cooled in a Two-stack Unit Such as Shown; Fans Blow Air upward through the Work Baskets

unit by chains and similarly discharged from the opposite end of the unit when cooling has been completed.

While the baskets of hot work are completely enclosed in the cooling unit, air is forced upward through the braided bottoms of the annealing baskets by large motor-driven fans near the floor. This air is discharged to the roof of the plant through two exhaust stacks. Cooling of the cups requires approximately 30 minutes.

When the baskets of cups leave the cooling unit, they are delivered to a large pickling and washing unit, such as seen in Fig. 6. Here the cartridge cases are unloaded from the annealing baskets and placed in wire baskets which permit the pickling-acid and water sprays to reach all surfaces of the cartridge-case cups. To facilitate unloading the annealing baskets, the conveyor that brings them to the washing machine has a tilting section.

The first operation performed by the pickling and washing machine consists of spraying a solution of 15 per cent sulphuric acid on the parts for a period of eight minutes as the work baskets move along a conveyor. This stage of the process thoroughly cleanses the cups of all dirt and grease. Then the baskets of work are carried past sprays of cold water for another period of eight minutes. At the end of the washing there is a slight coating of rust on the cases, which aids the next drawing operation by insuring adherence of the drawing lubricant.

This sequence of annealing, cooling, pickling, and washing follows each drawing operation on the cups. There are separate furnaces and cooling and pickling units for the successive draws, so as to avoid back-tracking of work and interruption of production schedules. Conveyors expedite handling of work throughout the plant.

The cups for the larger sizes of cartridge cases go through a trimming operation prior to coining. In this operation, the top edge of the cups is sheared off around the outside of the cups for a thickness of about 1/16 inch. If this operation were not performed, the sharp edge would form a seam in the cartridge case and cause rejection of the case.

One of the presses used for coining 75-milli-

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meter cups is illustrated in Fig. 7. It will be seen that this press is equipped with an indexing table having five sets of dies. At each down stroke of the press ram a spring-backed blank-holder assembled around the punch comes in contact with the top of the cup in the die that has been indexed beneath the punch, and holds it steady while the punch comes down and forces the cup into the die. The coined cups are raised by spring ejectors in the center of the dies as they again reach the front of the press. Two girls run one machine; one girl applies lubricant to the cups while the other girl feeds and unloads the indexing dies.

As already mentioned, 37- and 40-millimeter cartridge cases are coined directly from the round blanks. Fig. 8 shows a 750-ton press equipped for coining 40-millimeter cups. In this operation, a recess is also formed in the head, as can be seen from the cup shown lying on its side in the illustration. On the inside, the bottom of the cup runs straight across and is joined to the wall by generous fillets.

These cups are also raised from the die at the end of the operation by the action of a coil spring beneath a movable die section which forms the recess in the head end. The upper die section is, of course, stationary.

As each cup is brought to the top of the die the operator brushes it to the rear in the same movement with which she pushes a new blank on the die. The coined cups fall on a chute which carries them to a skid box. As in the drawing operations, the punches used in coining are chromium-plated, but the dies are made entirely of hardened steel without the tungsten-carbide inserts provided on the drawing dies.

After being coined, the cups go through annealing, cooling, pickling, and washing operations identical to those performed after "precupping," in order to prepare them for the first drawing operation. Fig. 9 shows a press set up for performing this drawing operation on 105-millimeter cartridge cases. The operation is performed by pushing the cups through the die, after which they fall on a conveyor belt that

Fig. 6. General View of a Typical Pickling and Washing Machine through which the Annealed Cartridge-case Cups Pass after They Leave the Cooling Unit

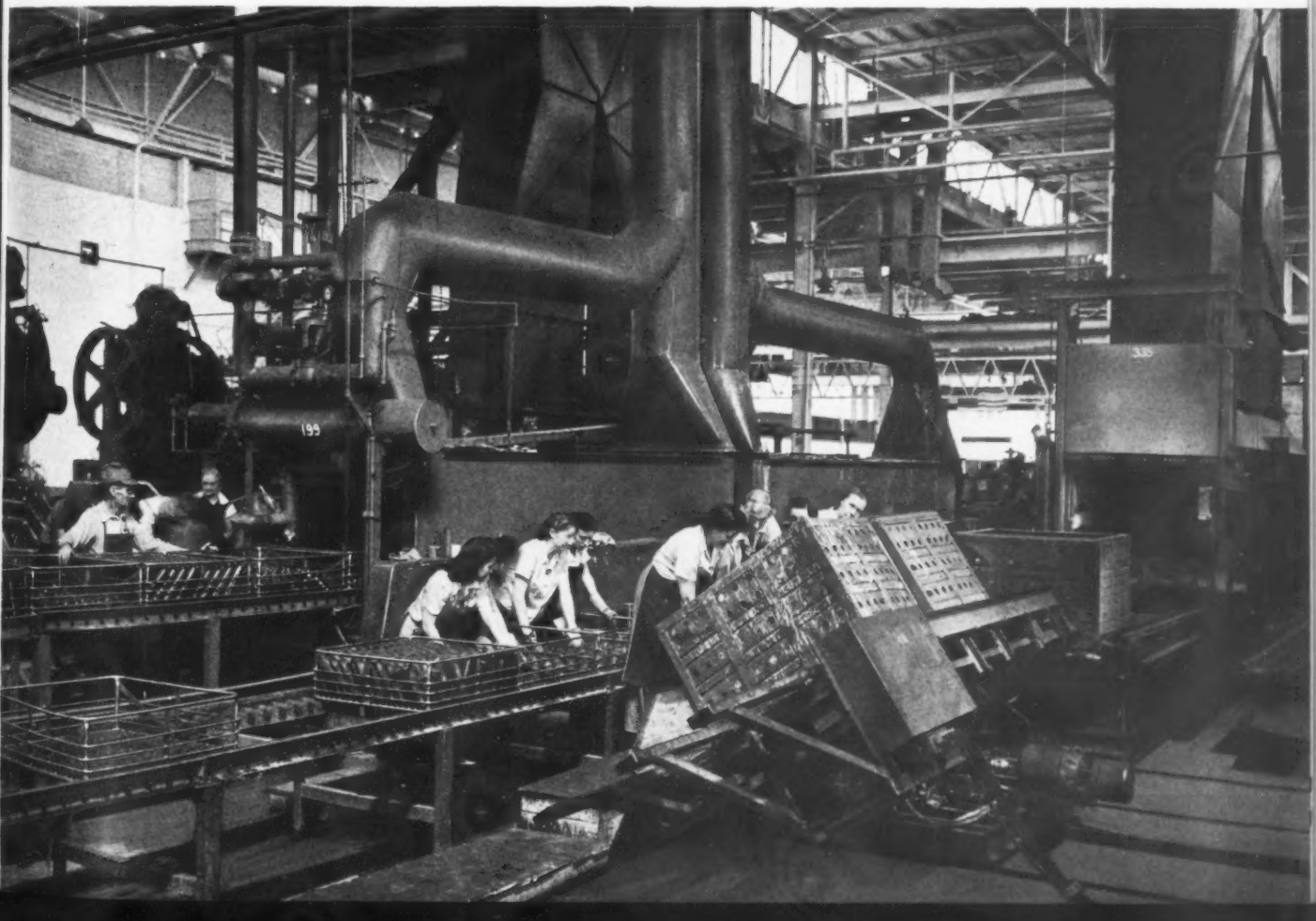


Fig. 7. Power Press Set up with Five Die Units for Coining 75-millimeter Cups

Fig. 8. Cups for 37- and 40-millimeter Cartridge Cases are Coined directly from the Disk-like Blanks

carries them to annealing baskets. In this operation, the thickness of the material is decreased about 1/8 inch. A press of 175 tons rating performs the operation.

The punch used in this operation, as in all drawing operations, has a tungsten-carbide insert and a spring-backed stripper plate. The stripper plate is of a split construction, with tapered outer edges, and is fitted in a recess with a tapered counterbore in which a certain amount of vertical movement is allowed under the pressure of the descending punch and cartridge case. The segments of the stripper expand when they are pushed downward with the cartridge case, and thus permit the case to pass through the stripper as the punch completes its stroke. On the return movement of the punch, the stripper segments are pulled upward within the limits of the recess, with the result that they are contracted, preventing the cartridge case from rising with the punch. It therefore falls through the die.

Stripping of the cartridge case from the punch is aided by a hydraulic arrangement

which imparts an initial kick to the case to loosen it from the punch. This hydraulic unit consists of a small cylinder into which oil is pumped during the return strokes of the punch and while it is in the raised position. A check-valve normally prevents the oil from flowing into a hole that extends the full length of the punch to the bottom end.

However, as the punch nears the end of its down stroke and the plunger of the hydraulic unit comes in contact with a stop, the plunger is forced upward into the cylinder, and the oil is compressed. Then, as the check-valve is automatically opened, the oil "shoots" down the hole extending the length of the punch and imparts a quick kick to the bottom of the cartridge case on the inside.

Five drawing operations are performed on each cartridge case, as indicated in Fig. 2. During these operations on 37-millimeter cases, the original 0.400- to 0.420-inch thick blanks are drawn out to a minimum thickness at the mouth of the cases of from 0.026 to 0.030 inch; the 0.535- to 0.560-inch blanks for 40-millimeter cases are drawn to a minimum thickness of about 0.030 inch; the 0.432- to 0.457-inch blanks for 75-millimeter cases are drawn to a minimum wall thickness between 0.030 and 0.040 inch; and the 0.490- to 0.515-inch thick blanks for 105-millimeter shells are drawn to a minimum thickness of between 0.030 and 0.040 inch.

Prior to the final draw there is a trimming operation for cutting the length of the cartridge case to the proper dimension and for eliminating uneven edges that might interfere with successful drawing. These trimming operations are performed by machines equipped with a circular cutter, which is automatically brought into contact with the rotating cartridge case after it has been fed into the operating position from a magazine. (A machine of this general type was illustrated in Fig. 17 on page 134 of April, 1941, MACHINERY.)

After the fifth draw and the subsequent annealing operation, the cartridge cases are headed. Cartridge cases of 75-millimeter size and larger are headed on Bliss Hydro-Pneumatic presses, set up with a two-station die table, as illustrated

Fig. 9. Machine Set up for Performing the First Drawing Operation on 105-millimeter Steel Cartridge Cases

Fig. 10. Hydraulic Press with a Two-station Die Table and One Punch is Used for Heading Larger Steel Cartridge Cases

Fig. 11. Cartridge Cases of the 37- and 40-millimeter Sizes are Headed in a Power Press Provided with an Eight-station Die Unit

in Fig. 10. When each cartridge case is slipped into one of the dies, it rests on a post in the center of the die, this post being almost as large in diameter as the inside of the cartridge case. The top of the post is machined with a recess for heading the inside of the case, while the end of the punch is finished to form the outside of the head end of the cartridge case.

The cartridge cases are loaded at the front of the press and indexed to the rear for the heading operation, the punch being mounted on the back end of the ram. After each case has been headed, it is again indexed to the front of the press, where a slide descends with the press ram, and by means of hinged fingers, grabs the flange of the headed cartridge case. When the ram returns upward, the fingers pull the case from the die as illustrated.

One of the girl operators then removes the headed case from between the lifting fingers and places it in a skid box, while the second girl loads the next cartridge case into the empty die. A pressure of 1500 tons is applied in heading the 105-millimeter cartridge cases being handled in the operation shown.

Cartridge cases of the 37- and 40-millimeter sizes are headed in power presses equipped with an eight-station die unit, such as shown in Fig. 11. The dial on which the dies are mounted is actuated between successive strokes of the press ram through a ratchet mechanism that is connected to the crankshaft. In this set-up,

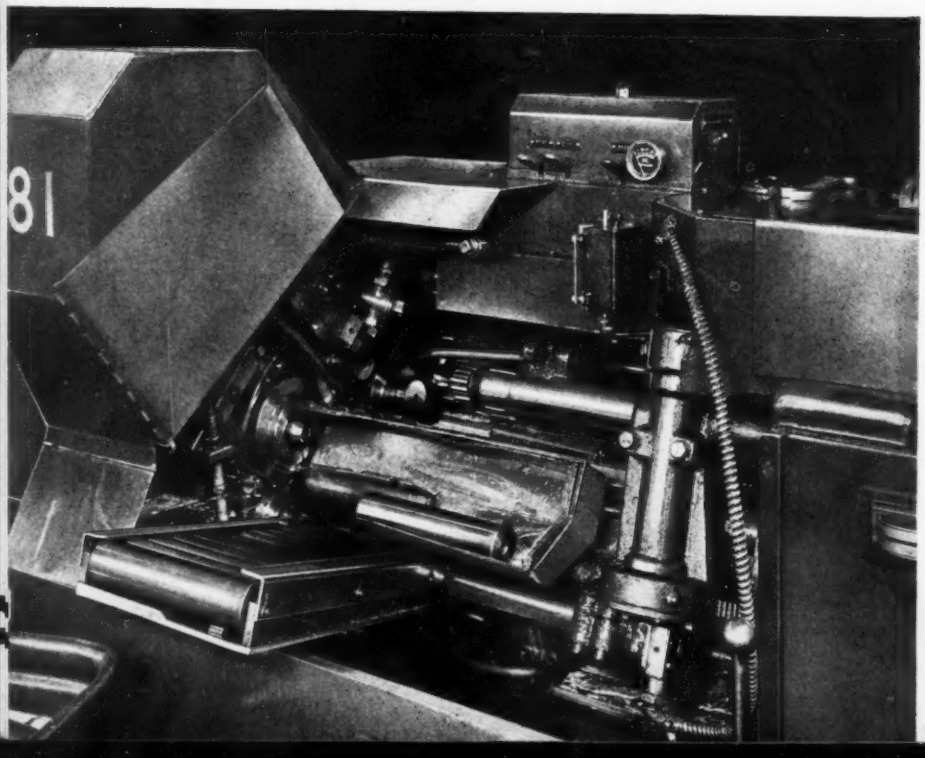


Fig. 12. Automatic Screw Machines are Employed for Performing Drilling, Reaming, Turning, Facing, and Grooving Cuts on Head End of Cartridge Cases

also, each die is constructed with a central post having the necessary impressions machined on top, and a set of fingers is attached to the front of the ram for lifting each headed cartridge case from its die. One girl loads this press and another unloads. The press has a rating of 600 tons.

Cartridge cases of the 37-millimeter size next have a primer hole pierced through the center of the headed end in a simple set-up on a power press. These cartridge cases are then transferred to automatic screw machines for machining the head end. On all other sized cases the hole is drilled in the automatics simultaneously with other cuts.

A six-station New Britain-Gridley automatic screw machine set up for machining 37-millimeter cartridge cases is illustrated in Fig. 12. The machine is equipped with a chute for automatically loading the cases, and each finished case is discharged into a sheet-metal holder at the front of the machine from which it can be easily removed by the operator.

Fig. 13 shows diagrammatically the tooling provided on a similar machine for finishing the heads of 40-millimeter cases. It will be seen that the first station is used for loading and unloading only. In the second station, a center is drilled in the cartridge case and a facing cut is taken; in the third station, the primer hole is drilled through the head end by a 33/64-inch drill, and a tangent turner rough-machines the flange; in the fourth station, the primer hole is enlarged by a drill to a diameter of 0.615 inch, and the extracting groove is rough-machined in back of the flange; in the fifth station, the retracting groove, the periphery of the flange, and the front edge of the flange are all finished by a single form tool at the same time that a cannelure groove is cut in the face of the head end; finally, in the sixth station, the primer hole is finish-reamed, the cannelure groove is finish-turned, and the head end is faced.

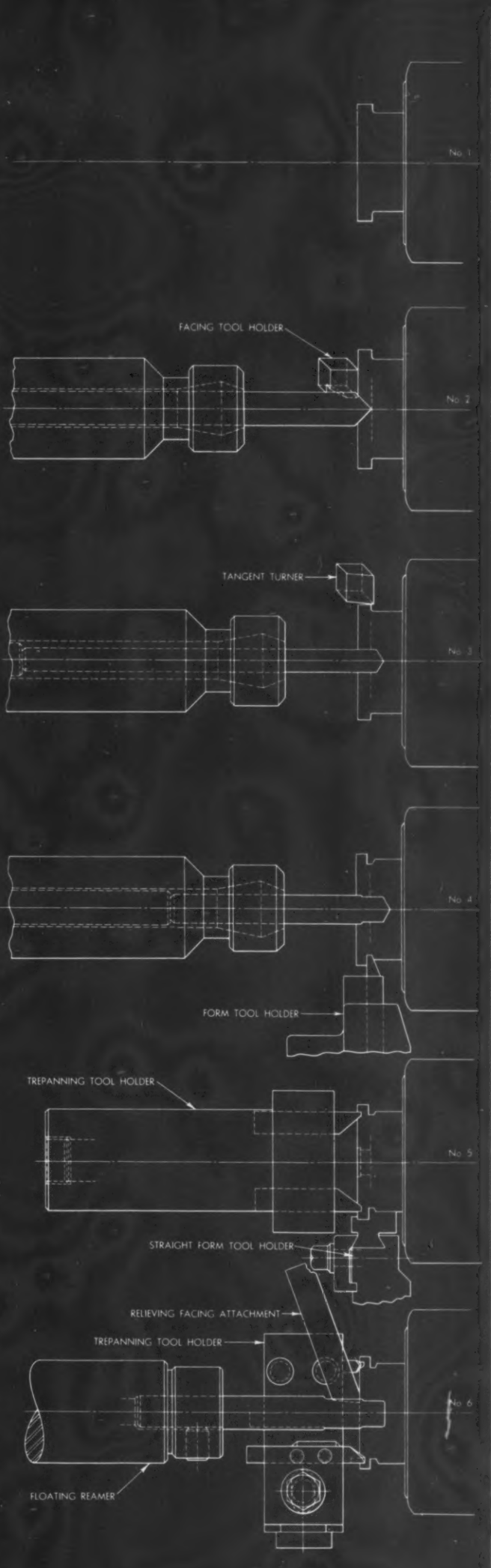


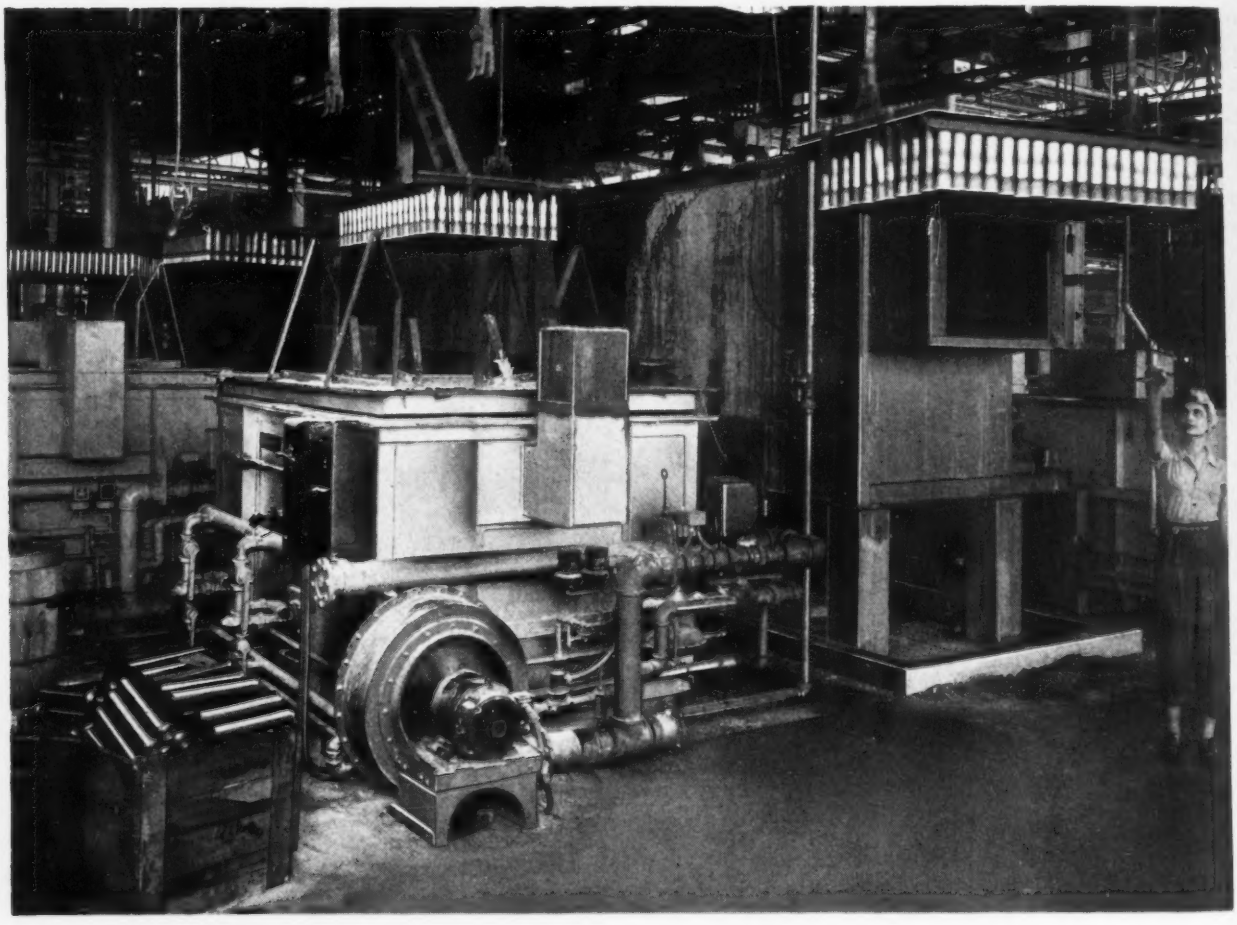
Fig. 13. Diagrams which Show the Tooling Provided on an Automatic Screw Machine for Finishing the Head End of 40-millimeter Cartridge Cases

After the 37- and 40-millimeter cartridge cases have been machined, they are annealed in a molten salt bath preparatory to tapering the wall. For the annealing operation, the cartridge cases are loaded in racks with the open or mouth end extending downward, as seen in Fig. 14. Each rack holds 198 cartridge cases at a time. They are submerged for approximately three minutes in a bath of molten Kalanneal, which consists of both potassium and sodium salts. This bath is maintained at a temperature of 1250 degrees F. in the furnace seen in the center foreground of the illustration. The cases are submerged for a depth of about 2 1/2 inches. It is not necessary to anneal the larger sizes of cartridge cases prior to tapering.

When the cases come from the annealing operation, they are run through the washing machine seen at the right in the same illustration. During the passage through this equipment, they are first lowered into a degreasing tank in which trichloromethylene is employed in vapor form. The racks of cases are then carried through a spray pickling operation and a water spray in equipment similar to that used after the various drawing steps.

Two operations are next performed on punch presses to form the taper on the mouth end of the cartridge cases. The smaller sizes are tapered on presses equipped with an indexing dial having eight die stations, as seen in Fig. 15. A girl operator loads the cases loosely into deep dies, and they are forced down into the die by the descending punch as each case is indexed

Fig. 14. Two Salt Bath Furnaces Used in Annealing the Cartridge Cases are Seen at the Left, and a Washing and Pickling Machine at the Right



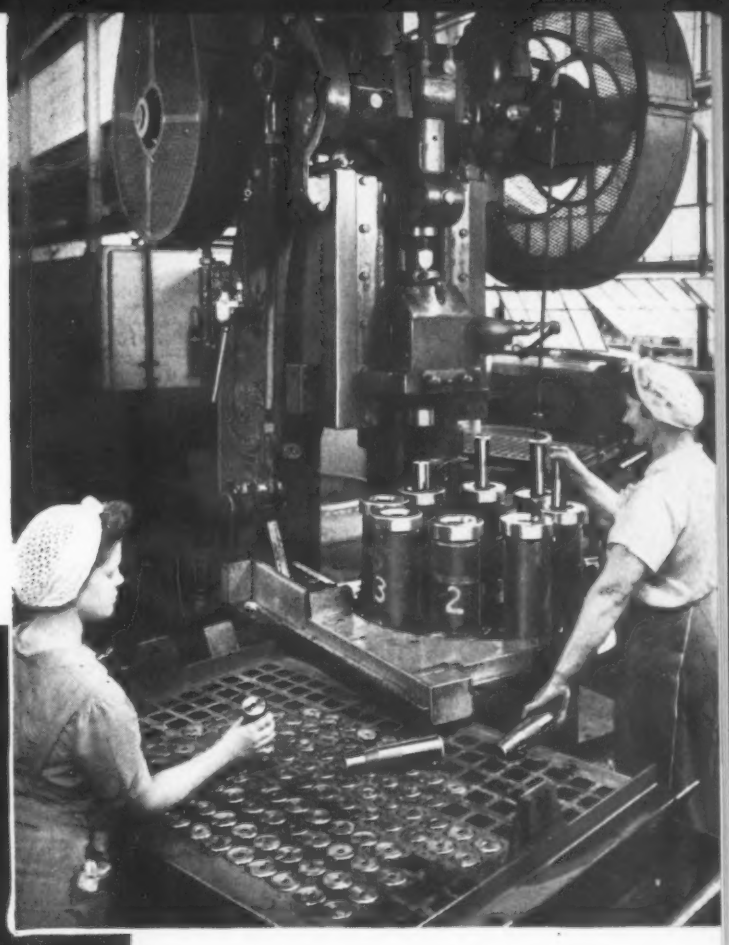


Fig. 15. The Taper-forming Operations on the Smaller Cartridge Cases are Performed on Machines Having Eight Sets of Dies

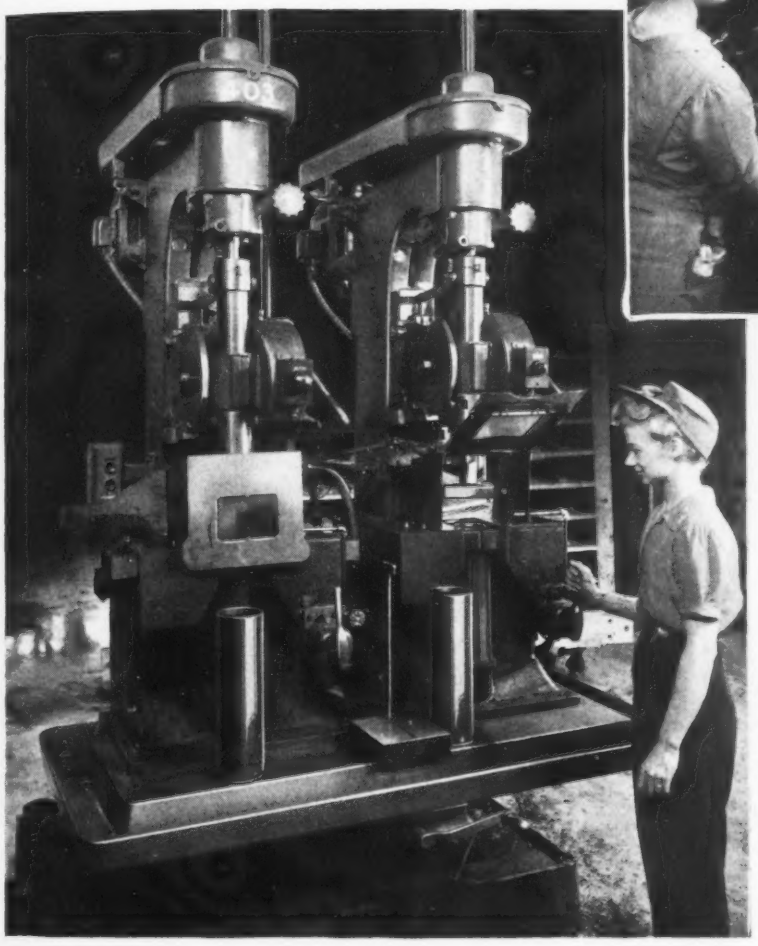


Fig. 16. Trimming Cartridge Cases to Length on a Two-spindle Drilling Machine Equipped with Cam Feeds that Greatly Expedite the Operation

under the ram. Oil is generously rubbed on the cases prior to this operation to facilitate the forming. When the tapered cases reach the front of the table, they are automatically raised by posts in the center of the dies, so that they can be easily removed.

Upon the completion of the tapering operations, the cartridge cases are returned to the bath annealing furnaces for annealing the mouth end. This operation is performed to a shorter length than the annealing operation prior to tapering. All sizes of cartridge cases are mouth-annealed.

The last machine operation on the cartridge cases consists of trimming them to length. Fig. 16 shows this operation being performed on a two-spindle upright drilling machine, each spindle of which is equipped with a disk cam

that gives a fast downward approach of the tool to the work, a slow feed, and a fast return to the starting position.

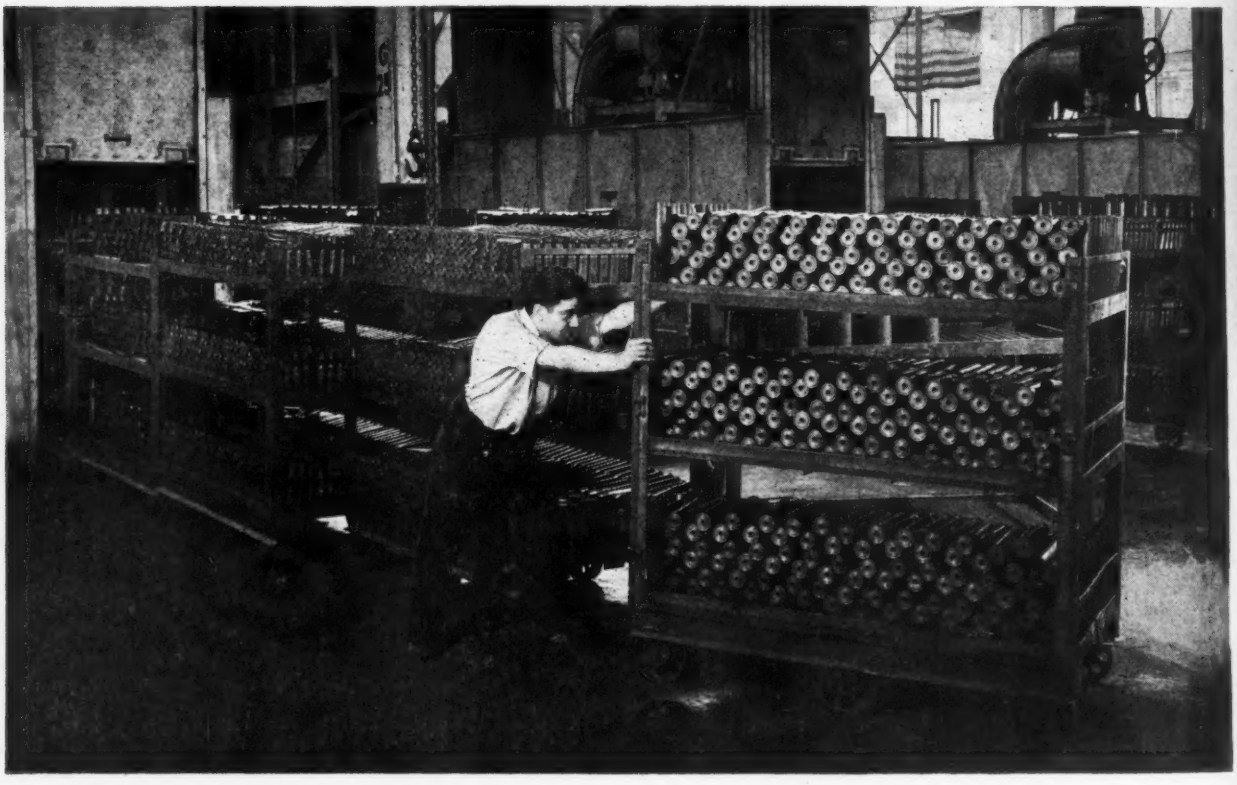
The flange of the cartridge case is seated in a ring that can be adjusted for height. Air-operated jaws slide in horizontally to grip the case near the upper end and thus prevent chattering. The single bit cutter is ground to a U-shape and is attached to the outer end of a holder at the required radius. A blast of compressed air directed from a small pipe line at the front of the fixture blows away the fine chips. Each cartridge case is inspected for height by means of the gage seen on the machine table. While the illustration shows the set-up employed for 105-millimeter cases, the principle employed in trimming cases of smaller caliber is exactly the same.

The trimmed cartridge cases are next stress-relieved in furnaces such as seen in the background of Fig. 17. For this operation, they are loaded on trucks that hold about 1500 cases at one time. These trucks are held for two hours in a section of the furnace that is maintained at a temperature of 750 degrees F. They are then kept in a cooling section for approximately 1/2 hour. The furnaces are approximately 50 feet long.

After the cases come from the stress-relieving furnace, they are delivered to the end of belt conveyors, such as seen in the heading illustration, and carried past a long row of women inspectors. Each cartridge case is checked for every dimension and also inspected visually both inside and outside as it moves along the conveyor lines. At the end of each conveyor line the cases reach an Army Ordnance inspector, who places them in an Electrolimit gage to recheck each dimension. If any tolerances are exceeded, lights flash on to indicate the elements that fail to pass inspection requirements.

Upon the acceptance of the cartridge cases by

Fig. 17. Cartridge Cases of All Sizes are Stress-relieved in Long Furnaces while Stacked in Large Numbers on Trucks



VICTORY

Fig. 18. Placing Cartridge Cases on Hooks Ready to be Transferred to the Conveyor of a Varnishing Unit and a "Detearing" Unit

Fig. 19. Copper Screens, Charged with Electrical Current of Extremely High Voltage and Low Amperage, Remove Excess Varnish from the Cartridge Cases

these Ordnance inspectors, they are thoroughly cleansed and rustproofed by dipping successively into a tank of phosphoric acid, a water rinse, and a tank containing a basic chromate solution which acts as a rust inhibitor. The entire process is performed within thirty seconds. This operation is carried out simply to insure cleanliness of the cartridge cases and to prevent corrosion of the cases before they are varnished.

The cartridge cases are next varnished to guard against any corrosion before use. For this operation, they are loaded on hooks, as shown in Fig. 18, which are inserted in the primer holes, and they are then transferred to bars of the moving chain conveyor seen in the background. As the cases are carried along this conveyor line they are first dipped into a tank of Zapon, which is a plastic base varnish.

When the cases leave this tank, the varnish runs down along the cases and leaves a uniform coat, except for a "ring" of varnish around the mouth. This ring of varnish is drawn off by a "detearing" unit, which consists of two copper screens, such as seen in Fig. 19. These screens

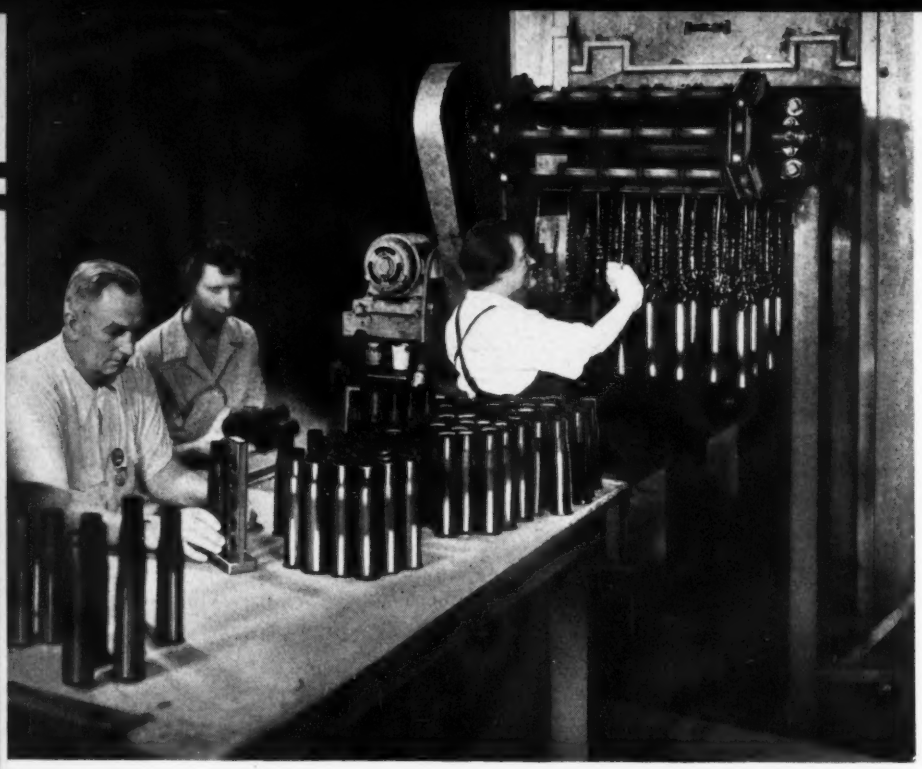


Fig. 20. After Varnishing, the Cases are Carried through a Long Baking Oven, and then Once More Inspected before Packing for Shipment to Shell-loading Plants

are charged with electrical current of 80,000 volts and of low amperage.

As the cases approach the first of these screens the electrical current pulls off the excess varnish in the form of a spray before the cases actually reach the screen. The second screen takes off any varnish that may accumulate at the mouth of the cases after the first screen has been passed. It is the practice to keep heavy wrapping paper over the screens to soak up the excess varnish rather than to let the screens be exposed as shown. If they were not protected in this way, frequent cleaning of the screens would be necessary.

When the varnished cases reach the end of the "detearing" unit, they are transferred to a baking oven, approximately 50 feet in length. This oven is equipped with a conveyor having cross-bars, about 6 inches apart, on which the cases are suspended. The conveyor arrangement will be apparent from Fig. 20, which shows the discharge end of the oven. When the cases go into this oven, they first enter a preheating section, then a baking compartment, which is maintained at a temperature of 475 degrees F., and finally a cooling section. The cases remain in the baking compartment about twenty minutes.

After the cartridge cases have been taken from the baking-oven conveyor and placed on the bench shown in Fig. 20, they are given a final check by factory and Ordnance inspectors. The cases are then packed in containers for shipment to shell-loading plants.

In manufacturing steel cartridge cases in the plant here described, every machine operation is performed by women, and women also perform all inspection operations, run cranes, drive factory trucks, and so on. Men are employed only for supervision, setting up machines, and doing the heavier work.

VICTORY

Design of Stampings to Facilitate Production

By RALPH A. WAGNER, Chief Tool Designer
Consolidated Aircraft Corporation, San Diego, Calif.

Detailed Data on the Design of Stampings for Quantity Production, Types of Stampings Made, Materials Used, and Die Design Suggestions—Second Article of a Series

IN the first installment of this series of articles, published in September MACHINERY, the broad classifications of stampings were reviewed and an outline was given of the kinds of materials generally used for stampings. The present article discusses details of stamping design.

Much can be done by the designer to facilitate the manufacture of stampings and thereby reduce their cost. When stampings are so designed that they cost more to produce than simpler designs would, there is usually a good reason for this; but product designers who have not had the opportunity to design dies for stampings are likely to overlook certain simple rules that should be followed in designing the stampings themselves.

Supervising engineers are not always able to go into the detail designs of individual stampings, and for that reason this work is often delegated to inexperienced men, who need to acquaint themselves with a few simple rules that tell what to do to simplify production and to insure that no unnecessary costs are incurred. The suggestions that follow are the result of the author's experience in manufacturing stampings from drawings submitted. Many of the designs could have been changed to effect savings, and the purpose would have been served just as well by the changed design. The points referred to are especially those that should be observed in order to obtain economy in production.

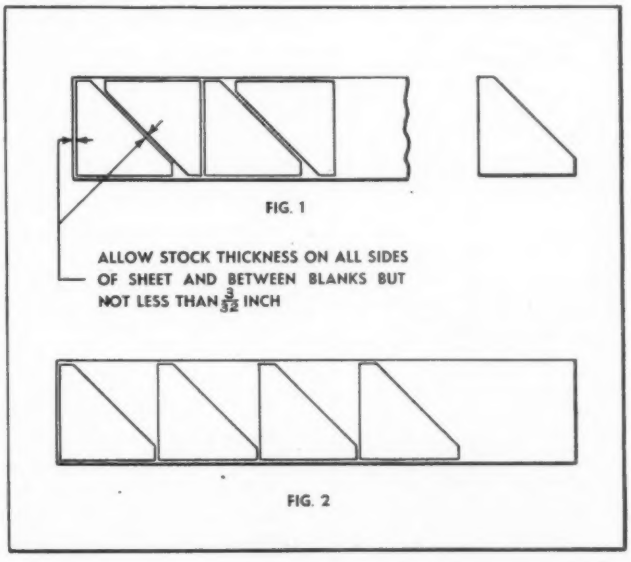


Fig. 1. Example where the Cutting of the Blanks from the Sheet has been so Planned as to Reduce the Waste Stock to a Minimum. Fig. 2. An Example where the Waste is Excessive

The cost of both dies and stampings obviously increases with size; hence, stampings should be kept as small as conditions permit. Sometimes costs can be reduced by making the stampings in more than one piece and subsequently assembling them, even though a single-piece design is feasible.

Stock lists should be studied, and standard sizes of strips or sheets, which are rolled without extra cost, should be chosen. The size that can be cut with minimum waste is, obviously, the most economical to use. The size and shape of blank required for each stamping must be determined in order to ascertain that it can be cut economically from a given size of sheet. If it is required to cut blanks 9 inches wide from a sheet, they can be cut more economically from a sheet 36 inches wide (in which case there will be no waste) than from a sheet 40 inches wide (where there will be a waste strip 4 inches in width at one edge of the sheet). The length of the sheet should also be considered to make sure that the waste at the end of the sheet, when the last pieces have been cut from it, is not excessive.

Figs. 1 and 2 show how pieces should and should not be cut from a sheet. In Fig. 1 is indicated an example of well planned "nesting"; in Fig. 2, an example where the waste is excessive. The design of the part can frequently be modified in size or contour to save material in cutting out the blanks. Often the blanks for two or more different

stampings can be so arranged that they will "nest" economically, and be cut simultaneously or in a progressive die from the same sheet.

Thickness of Stock for Stampings

Stock thickness should be as light as conditions permit, since the thinner stock is not only easier to work, but costs less. If it is not important that the thickness of the material be within the mill tolerance, it is well to so indicate, since this may mean a saving in the cost of the material. Furthermore, it may be possible to obtain from a mill or warehouse material on hand, ready for immediate fabrication, that can be used with little or no adjustment of tools or dies; whereas, if a definite gage is specified, it may be necessary to wait some time for delivery.

Type of Material to be Selected

Low-carbon steel is usually the lowest cost material, and should be chosen unless specific requirements necessitate the use of some other material. Sometimes, however, it is possible that some other metal which can be worked more easily, or costs less to finish, should be chosen, because the over-all cost will be lower. It is not always the first cost of the material, but rather the total cost of the finished piece, that should be considered. Such factors as surface smoothness are often important, as they have an effect on the finishing costs, and this, in turn, affects the over-all cost. For high-grade work, it is well to specify not only the type of material, but also the analysis required. When the use of seconds is permissible, material of this kind is sometimes available, and can be purchased at a lower price.

Effect of Direction of Grain of Metal

In designing a stamping, it is well to avoid bends and folds that are parallel with the grain of the metal. This is especially true in forming channel type products. The grain of the metal always runs parallel with the length of the sheet or strip. If channel type products—whether simply bent in the form of an angle or bent over on themselves—are to be made, the bends, as far as possible, should be across the grain of the metal to reduce the chances of checks and cracks. This should be considered, as well, when determining what width of sheet or strip will prove most economical.

The inside radii of bends should usually not be less than the thickness of the metal, as indicated in Fig. 3. The use of a larger radius than the thickness of the stock tends to reduce costs and is essential for all hard-tempered or otherwise non-ductile materials. In general, the larger the radius, the easier the part is to produce, especially when the radius is at the bottom of a drawn product.

When radii are specified that are less than the stock thickness, or when a sharp corner is required, as in Fig. 4, difficulty is encountered and the cost of production is increased, because one or more additional operations or "rehitting," to sharpen the corner, are required. Sharp bends are likely to fracture or tear the metal. This may necessitate a change to a more ductile and more costly material, or require additional annealing, as well as extra press operations. The tooling cost is also likely to be higher.

The radii at the bottom of drawn parts, whether cylindrical or other shape, should always be as large as possible (see Fig. 5). The punch stretches the metal in drawing it through the die, causing the metal to become thinner near the bottom radius. If the inside radius is too small, as indicated in Fig. 6, the metal may

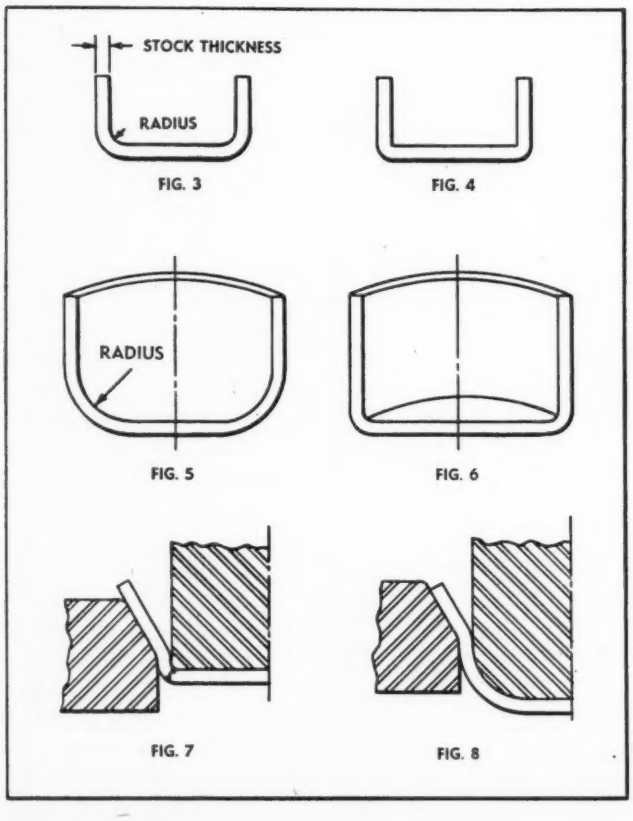
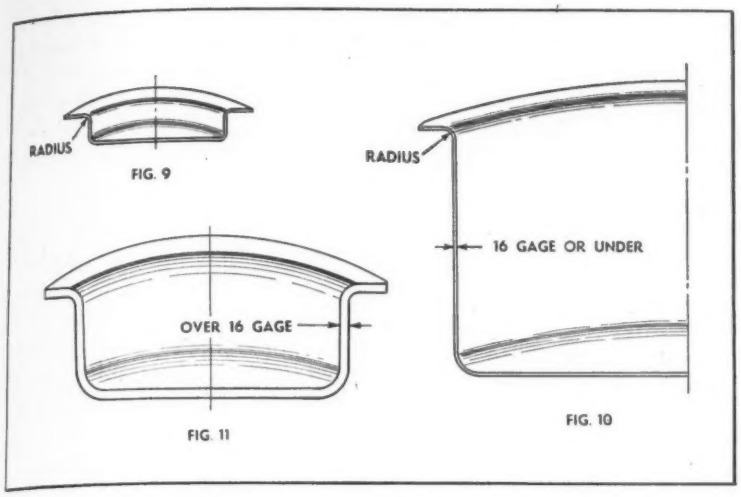


Fig. 3. Inside Radii of Bends should Usually Not be Made Less than the Thickness of the Metal. Fig. 4. When a Sharp Corner is Required, One or More Additional Operations to Sharpen the Corner are Necessary. Fig. 5. The Radius at the Bottom of a Drawn Cup should Always be as Large as Possible. Fig. 6. When the Inside Radius is too Small, the Metal may be Pinched between Punch and Die, so that the Bottom will Break out, as in Fig. 7. Fig. 8 Shows How This Difficulty is Overcome by the Use of a Larger Radius



Figs. 9, 10, and 11. The Radius under a Flange Should be as Large as Possible, but Never Less than the Stock Thickness

be pinched between the punch and die to such an extent that the bottom will break out (Fig. 7). The smaller the radius, the tighter is the pinching and the greater is the drag on the metal and the resultant stretching and thinning of the wall. A larger radius, as indicated in Fig. 8, will avoid this difficulty.

If a small radius is required, as in Fig. 6, it can be obtained by starting with a larger radius and then decreasing it gradually; but this adds dies and operations, and consequently increases costs. A radius at least four times the stock thickness, as in Fig. 5, is generally recommended at the bottom of drawn parts.

Products that have flanges at the top approximately 90 degrees to the side wall, as indicated in Figs. 9, 10, and 11, should have a radius under the flange of not less than the stock thickness. If the radius on the die is too small, regardless of what the radius on the punch may be, the material will pinch, and a ruptured stamping will be the result. It is always better to establish an inside radius at a flange to suit the draw radius necessary on the die, because if the radius specified is smaller, an additional operation for "rehitting" to the smaller radius becomes necessary, and an extra die must be made for this purpose.

The following practice is recommended: On very light-gage metal for small shallow parts, as in Fig. 9, the radius under the flange should not be less than 1/16 inch. On large parts with deep draws, using metal of 16 gage or thinner, as in Fig. 10, the radius at the draw edge should be between 1/8 and 5/16 inch. For materials over 16 gage, as indicated in Fig. 11, the radius under the flange should be 1 1/2 times the stock thickness. These figures apply to ductile metals suited for deep drawing.

Connecting radii, as used in paneling, embossings, or depressions, preferably should not be smaller than the stock thickness—if possible, they should be larger. The metal between an upper and lower radius should be at an angle greater than 90 degrees to the sheet, as shown in Fig. 12, and not at 90 degrees, as shown in Fig. 13. Considerable stretching of the metal takes place in forming a recessed or raised area, and ample radii, in addition to sloping connecting metal, tend to prevent any pinching action or tearing of the metal.

Inside corner radii joining the sides of rec-

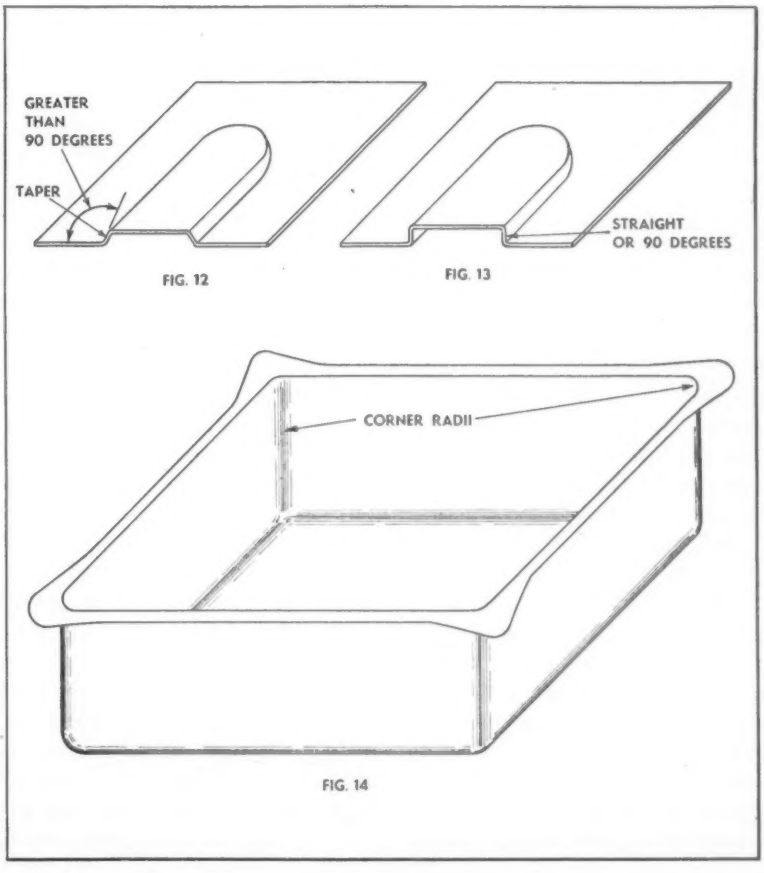


Fig. 12. The Metal between Two Bends Should be at an Angle Greater than 90 Degrees, if Possible, and not Straight, as Shown in Fig. 13. Fig. 14. Inside Corner Radii Should be Large Enough to Allow the Metal to be Pulled down at the Corners of the Die Walls without Tearing

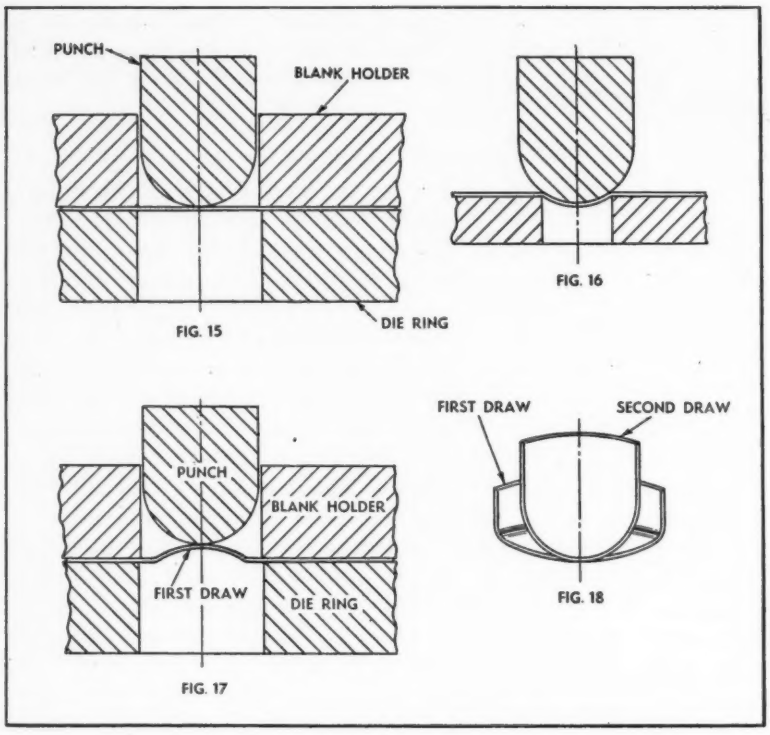


Fig. 15. Method of Drawing a Cup Having a Curved Rather than a Flat Bottom, which is Likely to Rupture the Sheet or Produce Wrinkles. Figs. 16, 17, and 18. Different Methods for Drawing a Cup with a Hemispherical Bottom Successfully

tangular or other straight-sided drawn stampings, as indicated in Fig. 14, should also be as large as possible to allow the metal to be pulled down at the corners of the die walls without pinching or tearing. The length of these radii depends upon the gage and type of material used, and the depth of the draw. On a draw 4 inches deep, using cold-rolled deep-drawing steel 0.037 inch thick, a corner radius five times the thickness of the material is the minimum feasible. On shallower or deeper draws, a corresponding decrease or increase in the radius is permissible or necessary; but for best results, the radii should be made as large as possible—larger than the minimum, if conditions permit.

In general, it can be said that square corners or edges, where forming or drawing of metal is involved, have no place in any but exceptional stampings, unless performed by a coining operation, which is expensive; and this usually is possible on relatively small parts only. When an unusually small radius appears essential, experienced stamping producers should be consulted to determine whether the radius is feasible without prohibitive cost.

Outside radii in corners or bends are usually determined by the requirements for the corresponding inside radii, and are, as a rule, equal to the inside radius plus the metal thickness. Square external corners can be formed by coining, but should be avoided unless absolutely essential. It should always be kept in mind that liberal outside, as well as inside, radii facilitate production and reduce costs.

The depth of depressions and the height of pads should not be greater than is absolutely necessary. The depth should not exceed twice the stock thickness, although if a hole pierced before forming is permissible in the center of the pad or depression, the depth can be increased, as some of the metal will be drawn from the relieved center portion.

The depth of draw should be kept as small as conditions permit, if minimum cost is desired. In general, the deeper the draw beyond that possible in a single stroke of the press, the higher will be the cost, because of the greater number of operations and the number of dies required. Drawing tends to work-harden most metals, and deep draws, therefore, often require that the metal be annealed and sometimes pickled and cleaned between draws. These operations add considerably to the cost and cannot always be performed with lighter-gage materials. Deep-drawing generally requires a highly ductile material, and this also involves greater cost.

Parts having a circular section are usually the easiest to draw, and the die costs are the lowest; hence, when a deep-drawn part is required, it should be designed with circular sections at right angles to the punch axis. For a given diameter, the deeper the draw, the larger the blank required and the greater the cost of material. Large blanks involve large scrap losses.

Despite these adverse factors, deep-drawing is often a highly economical method, and frequently is the only method possible for low-cost production. Draws as deep as the diameter of the punch cannot usually be produced in a single operation, but commonly require two or more operations after blanking and necessitate a corresponding number of dies. There are no fixed rules for determining the number of draws; but for ductile material to be converted into a deep cylindrical shape in a single draw, the punch area may be, say, 40 to 50 per cent of the blank area. If the sectional area of the punch exceeds 40 to 50 per cent of the blank area, one or more redraws may be needed. In redrawing, the sectional punch area is usually from 15 to 30 per cent less than the projected area of the piece to be redrawn.

Drawing stretches the metal as it is drawn over the rounded edge of the die. There is a definite flow of metal; and if either the punch or die has radii which are too small, the metal will be torn or ruptured, as previously indicated.

Shape of Drawn Parts

Although it is possible to draw parts having curved rather than flat bottoms, or even bottoms of hemispherical shape, a punch correspondingly shaped may tend to rupture the bottom or produce wrinkles, because as shown in Fig. 15, the part of the punch that first hits the metal is too far away from the die. There are, however, expedients for meeting this difficulty, as indicated in Figs. 16, 17, and 18. In Fig. 16, a shallow die is first used to decrease the distance from the punch to the die. In Fig. 17, the blank is reversed, and through this expedient it is possible to draw a hemispherical shape without causing wrinkles. Fig. 18 shows how the same end can be attained by a first draw of larger diameter, and a second draw of the required diameter.

Deep-drawing of parts of irregular shape, such as automobile fenders for example, is likely to require much expensive research work or cut-and-try methods before success is attained. To decide whether or not it is practicable to draw such parts is largely a matter of experience. It is well to determine whether parts of similar size, shape, metal thickness, and kind of metal have been successfully drawn at reasonable cost in the past.

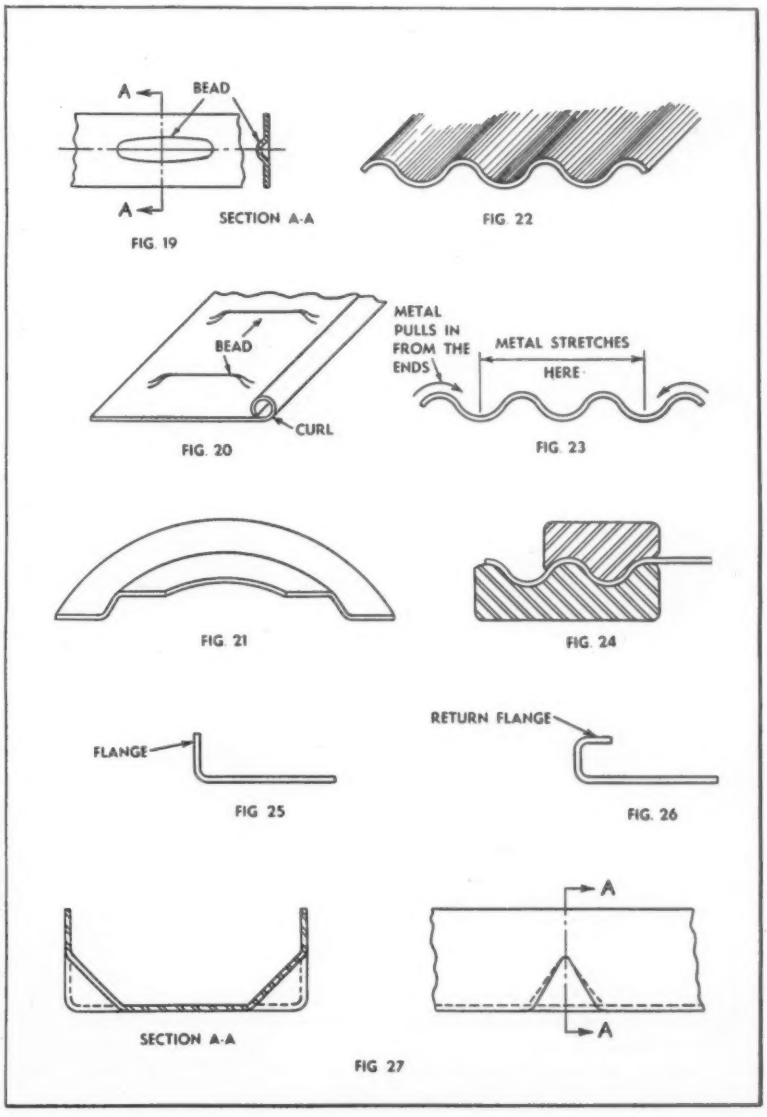
Many stampings require drawing or forming operations ranging from shallow to fairly deep draws over a part of their area, as, for example, in producing depressions or ribs to stiffen an area which, if left flat, might be too flexible. Examples of such parts are indicated in Figs. 19, 20, and 21.

Depressions or corrugations, as shown in Figs. 22, 23, and 24, however, require stretching or flow of the metal, and the design must be such that the flow can take place without rupturing the piece. Thus, two parallel depressions are often feasible if the radii are not too small and there is sufficient metal adjacent to the depressions to permit the draw; but if a third depression or bead is called for between the two, the metal may lock in the outer pair and be ruptured in the central depression for lack of material to flow into the latter.

In some cases, a series of depressions or corrugations can be made easily one at a time, in succession, as indicated in Fig. 24, where, if an attempt were made to form them all at one closing of the die, the stock would be ruptured.

The edges of stamped parts are often stiffened greatly by the addition of flanges, as in Figs. 25 and 26. An offset or flange around a hole, as in Fig. 21, stiffens the piece greatly. A rib formed as in Fig. 27 is often used to stiffen a channel section.

Whenever metal is drawn or formed for a rib or for a deeper depression, it is necessary to



Figs. 19, 20, and 21. Parts Requiring Drawing or Forming Operations over a Portion of Their Area. Figs. 22, 23, and 24. Methods Used in Producing Corrugations. Figs. 25 and 26. Stiffening the Edges of Stamped Parts by Flanges. Fig. 27. Channel Section Stiffened by Rib

provide sufficient metal to flow into the shape required, whether the metal comes from the outer area of the blank, as in drawing a cup, or as a result of enlarging a hole, as indicated in Fig. 21. Unless this is done, the piece is likely to rupture or to be drawn so thin at some points that it may fail in its purpose.

Irregular Drawn Parts

The making of irregular or special drawn parts involves a variety of problems, each of which must find a solution of its own. Most stampings are made with a solid punch which clears the die by an amount approximately equal to the thickness of the metal being drawn. In the case of some irregular parts, it is possible to employ a flexible rubber punch, which, after entering the drawn part, is made to expand and force the metal in the side walls into under-cut recesses in the die. When the pressure is relieved, the punch contracts in diameter and clears the piece, but the piece cannot be removed from the die unless the die is split. A piece that may be formed in this way and a diagrammatical section of the die are indicated in Fig. 28.

Conversely, if a solid punch has an under-cut, as in Fig. 29, it can be made to form an under-cut part, such as the wing leading edge for a plane. The die is made of rubber and is confined sidewise in a box, but allowed to flow around the punch, with the work between it and the punch. This method of forming and drawing a part over a punch is used widely in aircraft part production and is known as the Guerin process. If the punch or form has an under-cut, as in Fig. 29, it must, of course, be of such shape that the piece will come free after forming.

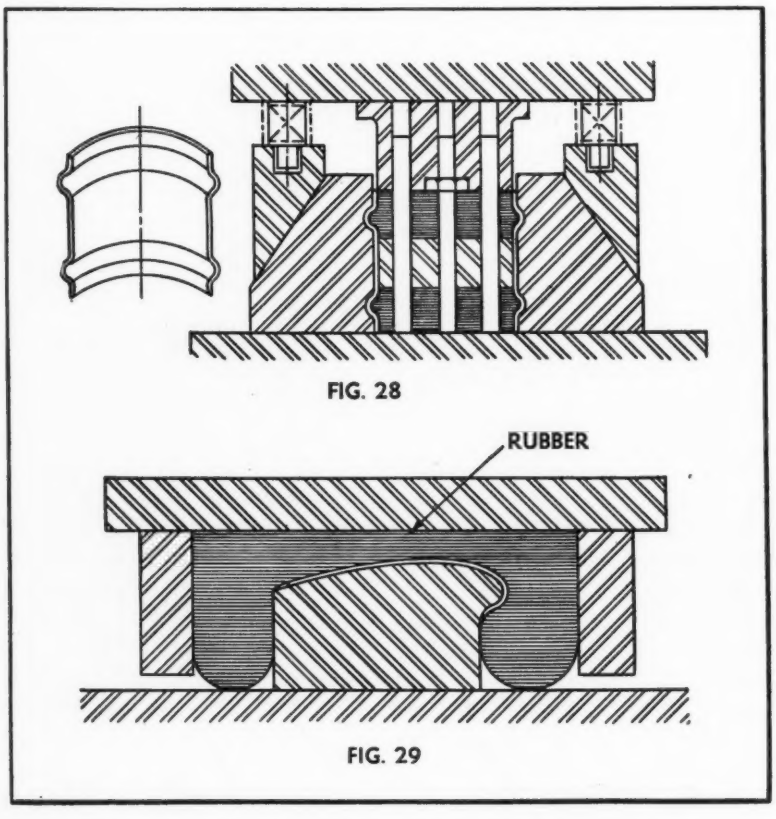


FIG. 28

FIG. 29

Figs. 28 and 29. The Use of Flexible Rubber Punches for Forming Irregular Shapes

* * *

Avoiding Noise Caused by Bar Running through Screw Machine Stock Tube

By CHARLES J. DALEY

The noise caused by the running of bar stock through the stock tube of turret lathes and screw machines is often objectionable. The writer has discovered a means whereby this noise may be eliminated. After trying wood, rubber, leather, and felt as a noise deadener, none of which would last any length of time, a piece of oily waste was wrapped around the end of the bar before it was put through the chuck. This simple method made about 50 per cent of the noise disappear. Another piece of waste was then wrapped around the bar about 5 feet from the end. When the machine was started up again, there was absolute quietness.

In shops where towels are used instead of waste, it is possible to get complete quietness by tying a piece of cord or tape to one end of the towel, winding the towel counter-clockwise around the bar, and tying one end of it to the bar.

Another advantage of this method is that it prevents the pounding on the front and rear bearings. Furthermore, the waste or towel wipes scale and dirt off the bar, preventing it from getting into the spindle and chuck.

* * *

There is a great deal of talk today about the rights of the individual to security. Democratic forms of government are supposed to justify such rights. As a matter of fact, democracy does not create rights; it creates opportunities that make it possible for the individual who is able and willing to make use of these opportunities to gain, by his own efforts, a greater measure of security than was formerly possible.

Machining Vital Parts of the 90-mm. Anti-Aircraft Gun Mount

A Few Examples of the Fine Work being Done on These Anti-Aircraft Gun Mounts in a Plant of the Worthington Pump & Machinery Corporation

By HOLBROOK L. HORTON

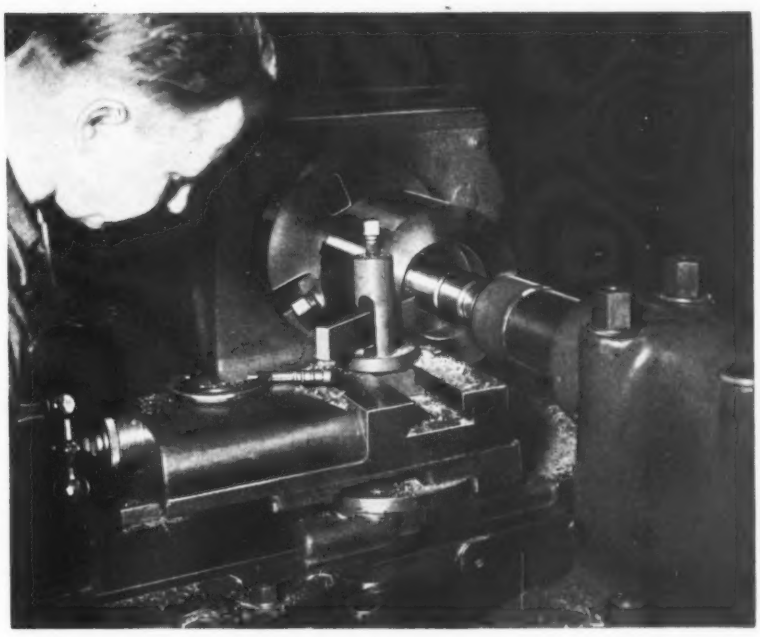


Fig. 1. Taking a Blind Cut to Form a Bearing Surface on a Manganese-bronze Worm Blank to a Tolerance of 0.0005 Inch

THE 90-millimeter anti-aircraft gun is one of the most potent weapons for aerial defense in the armory of the United Nations. With it, ground forces can bring down enemy planes flying at great altitudes. A good deal of the effectiveness of this gun is due to the ease and exactitude with which it can be aimed in response to the range-finder control. This ease and exactitude of operation derive from the accuracy with which the traversing assembly, elevating assembly, and leveling assembly—all units of the gun mount—are built. Some examples of work being done on these assemblies in a plant of the Worthington Pump & Machinery Corporation are described in this article.

One of the many operations on parts of these assemblies in which the tolerance is close is the relatively simple one shown in Fig. 1. Here a bearing surface is being turned on a LeBlond lathe inside the recess of a manganese-bronze leveling worm blank. A similar surface is turned inside the recess on the other side of the gear blank. A cemented-carbide tool is employed for this cut, and the diameter limits are 2.9500 and 2.9495 inches. Owing to the kind of material being turned and the fact that a blind cut is being taken, keeping within this small tolerance range is not as easy as it might appear.

The worm made from this blank meshes with a one-tooth rack having a 1 3/4-inch lead. The set-up

Fig. 2. By Using Die Chasers with a Smaller Throat Angle, Seizing and Tearing of the Metal were Avoided in Threading This Long Clevis Rod

for machining this rack presented somewhat of a problem, due in part to the relatively large lead that was required. At first, these one-tooth racks were made on a lathe, but this method proved to be entirely too slow. Finally, the problem was solved by doing the job in three separate operations.

First the straight tooth sides were roughed out on a shaper. Second, the sides of the tooth were milled to within about 0.015 inch of the required width, and the curvature on top of the tooth was milled. Third, the helical contour of the tooth sides was generated by means of a grinding operation.

The special machine designed for this grinding operation is shown in Fig. 3. The one-tooth rack is held in a fixture which is adjustable lengthwise along the ways of the machine. The small grinding wheel is brought up to one side of the tooth, and is then traversed across this surface in a helical path controlled by a cam movement. The position of the rack is then shifted and the other side of the tooth is similarly ground.

A hand feed is used, and to permit the necessary close adjustment for accurate grinding, a 3-inch diameter feed-wheel with a scale scribed in ten-thousandths of an inch is utilized. One revolution of the wheel produces a feeding movement of about 0.005 inch. About 0.006 to 0.008 inch is ground from each side. A tolerance of 0.001 inch is allowed in the width of the tooth. The rack is made of S A E 4140 steel.

Another difficult problem was cutting the threads on the counterpoise clevis rod, which is made from an S A E 1045 steel forging, heat-treated to 250 to 275 Brinell. The rod is 2 1/4 inches in diameter and is threaded for a length of 16 inches. A Class 3 fit is required.

The job was first put on a thread milling machine, but production proved to be too slow. It was then set up on a Warner & Swasey turret lathe, as shown in Fig. 2, and a Jones & Lamson die-head was used in one of the turret positions. The thread required had a pitch of 1/12 inch, and because of the small rod diameter, in comparison with its length, it was found that considerable torsional strain on the work resulted when die chasers with the customary throat angle for this pitch were used. Thus, when a die having Acme thread chasers with an 18-degree throat angle were employed, great difficulty was experienced with seizing and tearing of the metal. After several attempts to rectify

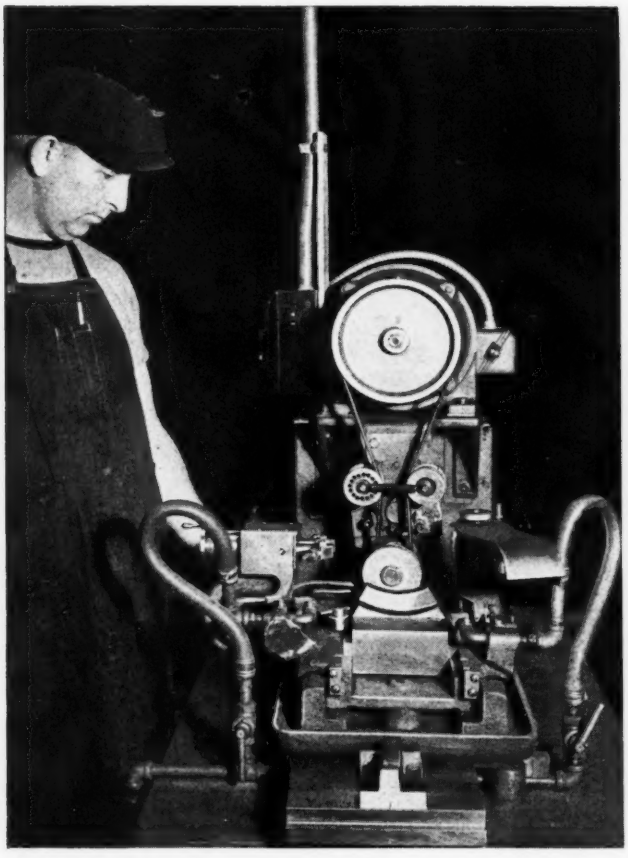


Fig. 3. Ingenious Arrangement Devised to Grind Helical Contour on the Sides of a One-tooth Rack

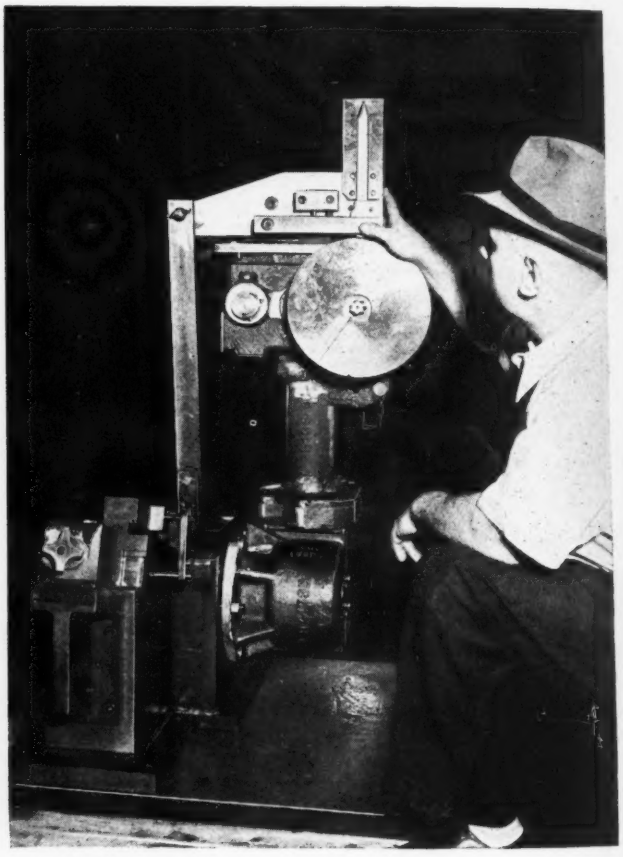


Fig. 4. Machine Designed to Test Elevating Gear Train for Backlash. No Backlash is Allowed in Finished Mechanism

this condition, it was found that by simply changing to Acme thread chasers with a 12-degree throat angle the difficulty was eliminated.

In Fig. 5, a large bronze bull gear, used to rotate or traverse the gun, is seen being tested for concentricity of the bearing, clip, and race with the outside circumference of the hub of the leveling assembly. This gear has 160 teeth and a pitch diameter of 40.125 inches. Its concentricity with the hub must be within 0.002 inch. Adjustable jacks, shown in spoke-like position, permit the relative position of hub and gear to be altered slightly as the measurements proceed around the gear from tooth to tooth.

All the gears used in the elevating and traversing mechanism must be finished with the greatest accuracy, and when assembled must show no backlash. To obtain the required finish and contour, they are first scraped by hand to an 85 per cent bearing surface, and are then lapped together until they have no backlash. Fig. 4 shows a special testing device which was built to provide an accurate means of determining whether or not any backlash is present in the elevating assembly.

The accurate location of gears in these assemblies is essential; thus gears that are to be mounted on splined shafts are shifted around in their position on the spline until they show the least amount of run-out. The splines on both gear and shaft must be cut to within 0.0005 inch, so that the gear can be finally located with great accuracy. Tolerances for the housings in these assemblies are close, running

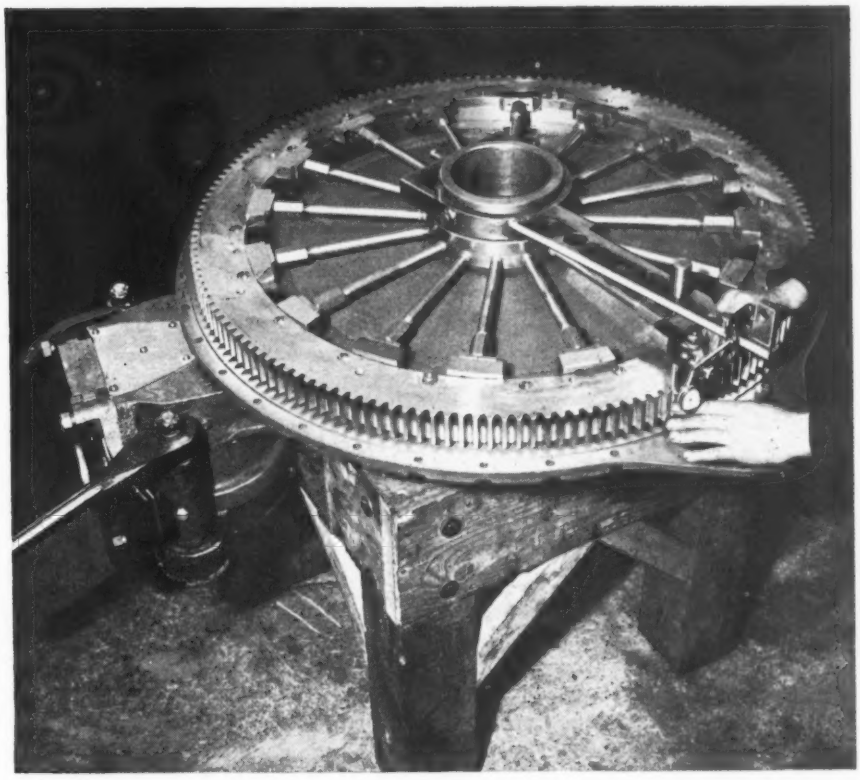
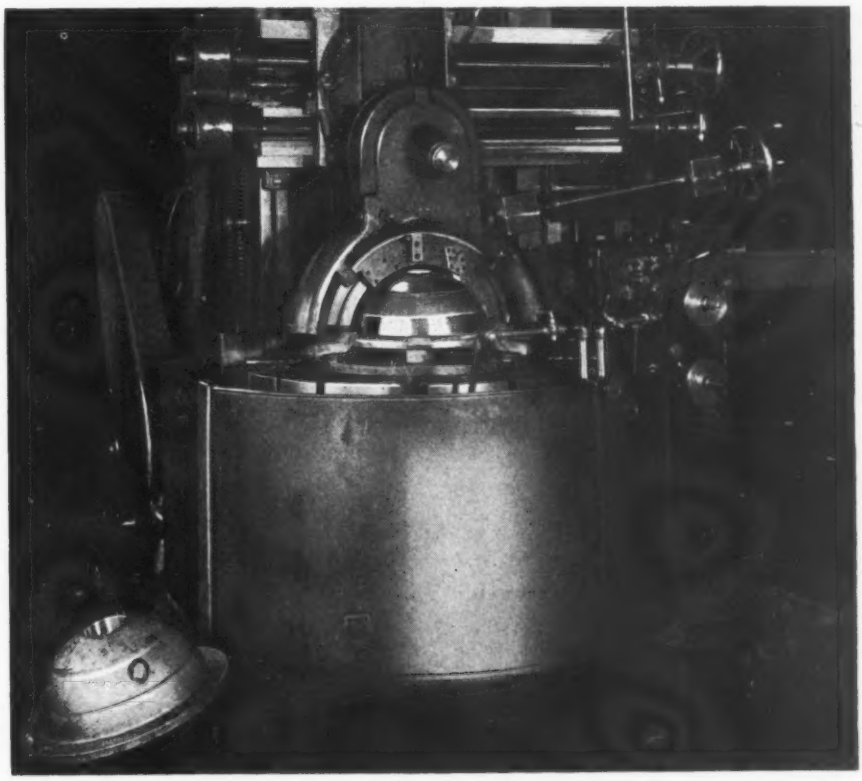


Fig. 5. Adjusting a Large Bronze Bull Gear to Exact Concentricity with Leveling Assembly Hub

Fig. 6. Turning the Bearing Surfaces of a Spherical Casting on a 54-inch Vertical Turret Lathe, Using a Special Attachment



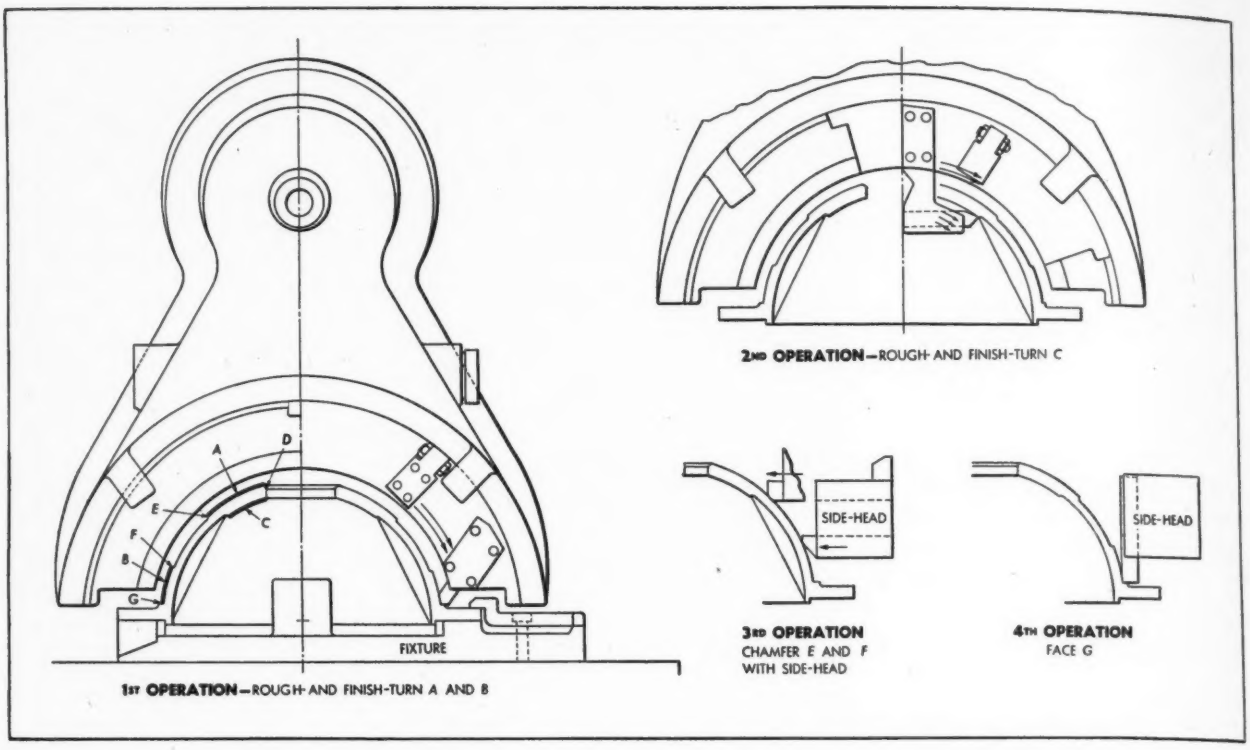
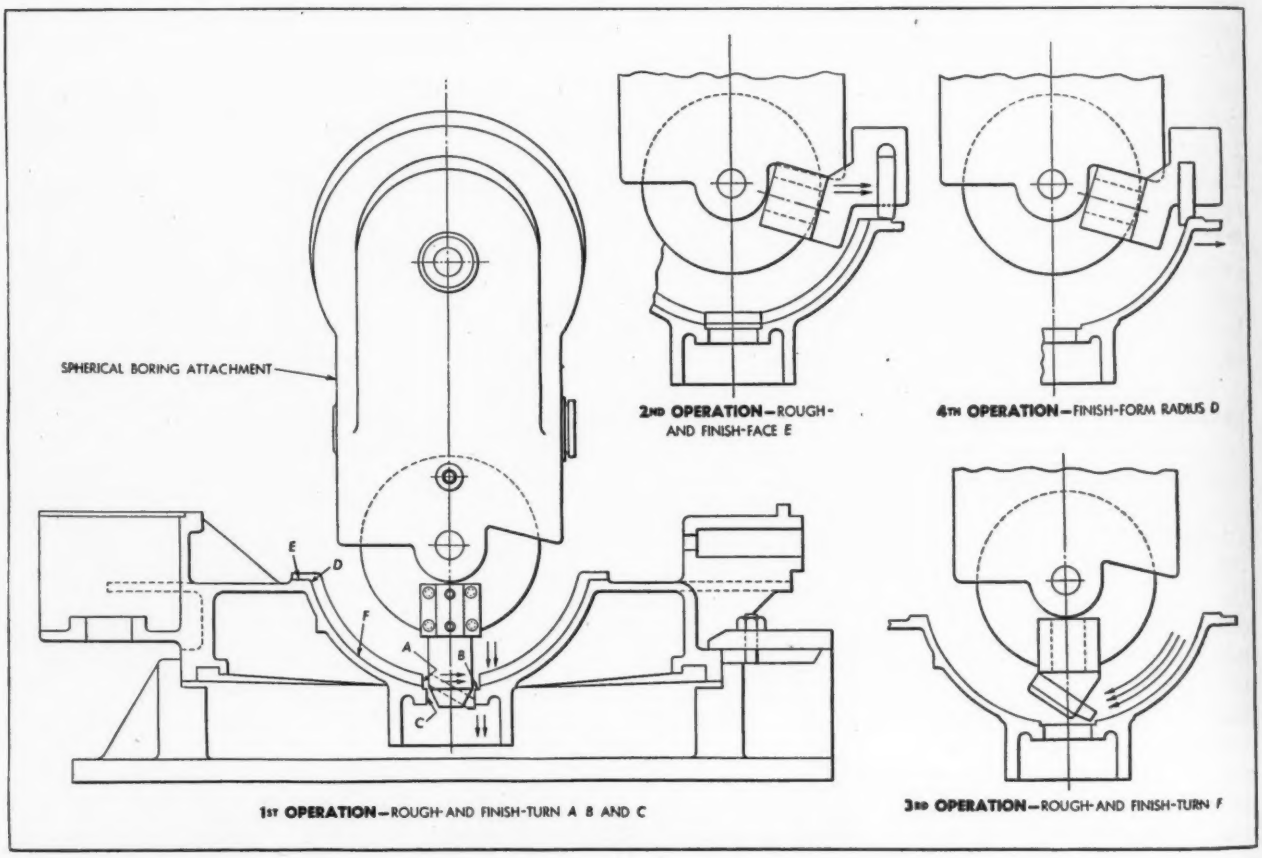


Fig. 7. This Special Attachment is Utilized to Turn Two Exterior and One Interior Bearing Surfaces on the Work-piece. A Side-head is Employed for Chamfering

Fig. 8. Because of the Two Projections Extending out from the Casting, It was Not Feasible to Employ a Side-head. A Special Attachment was, therefore, Used to Face off the Raised Collar and to Turn the Sides and Shoulder of the Bottom Hole, in Addition to Turning the Spherical Seat



down to 0.0008 inch. Even such a small item as a nut on the end of a shaft in the elevating assembly is ground exactly square to prevent it from forcing the shaft bearing into a slightly eccentric position.

Two somewhat unusual jobs are being handled on a Bullard 54-inch vertical turret lathe. These are the machining of the spherical and adjoining surfaces of the "dome" and the leveling socket. As shown in Fig. 6, the actual bearing surfaces on the "dome" are turned with the aid of a special attachment, which traverses the tool around the outside of the work-piece. The tool-head of this attachment is actuated through an auxiliary feed-rod which may be seen extending out from the right side of the attachment.

The first operation (after the second chucking), as shown in Fig. 7, is to rough- and finish-turn the two external bearing surfaces *A* and *B*. These are plainly visible on the work-piece in Fig. 6.

In the second operation, a straight-shank cutting tool in a right-angle tool-holder is projected through the hole in the center of the casting, and is traversed to turn the interior surface *C*, Fig. 7. (Surface *D* is machined in a previous chucking.)

In the third operation, two tools in a side-head are used to chamfer the corners of the exterior bearing surfaces at *E* and *F*. In the fourth operation, the side-head is again employed—this time with a single tool—to face off the fillet at *G*.

To turn the spherical seat of the leveling socket, another special attachment is used of a type opposite to that employed for the bearing operations. This attachment permits the tool to be traversed for turning internal spherical surfaces. As shown in Fig. 9, the tool-head is actuated through an auxiliary feed-rod extending from the side of the attachment. Because of the interference caused by two large projections extending from the casting, it was not feasible to employ a side-head for any turning operation along the top of the work-piece.

As shown in Fig. 8, the first operation (after the second chucking) is to turn the sides *A* and *C* and the shoulder *B* in the central hole at the bottom of the spherical cavity.

The second operation is to rough- and finish-face the raised shoulder *E* around the edge of the spherical cavity. The third operation is to rough- and finish-turn the main bearing surface *F*, using the rotating, traversing movement of the special attachment. The fourth operation is to finish-turn the radius *D*, using a form-cutting tool.

After being machined, both spherical bearing and socket are lapped to a fine finish in a specially devised automatic machine.

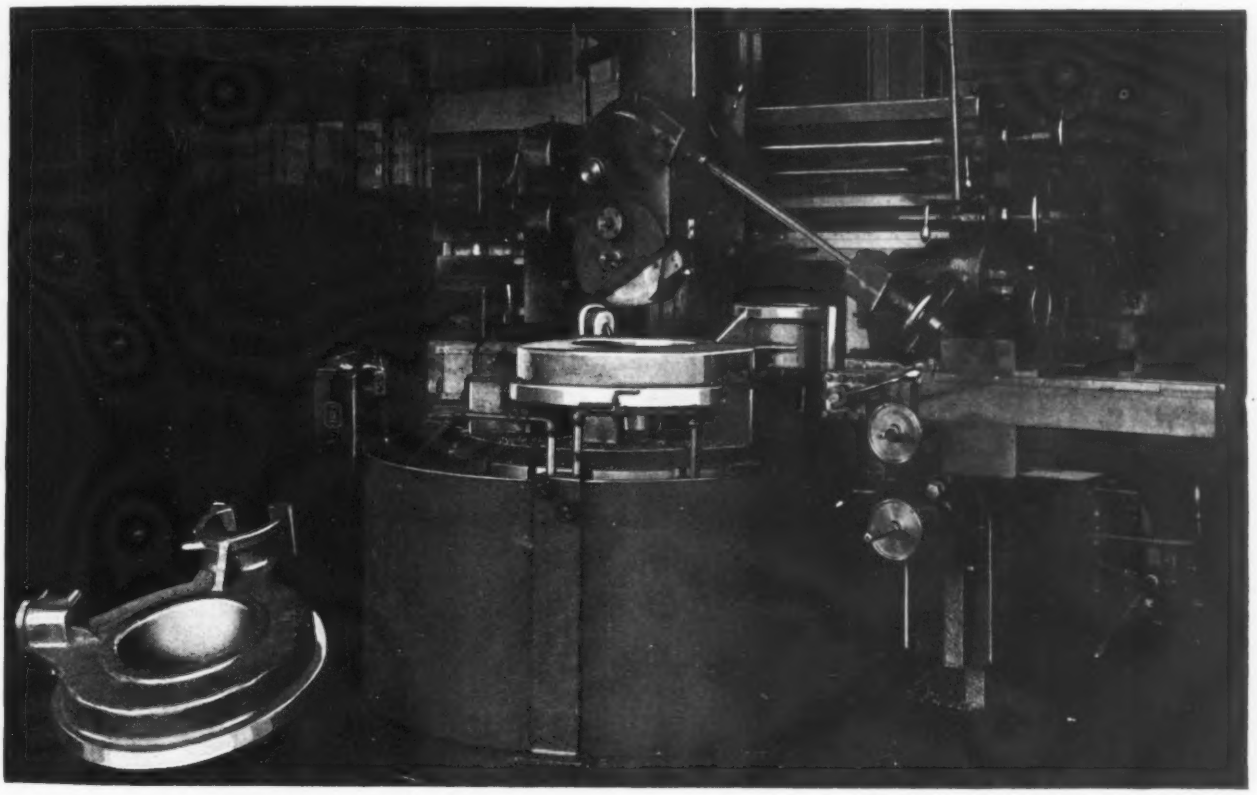


Fig. 9. Using the Special Attachment for Turning Concave Surfaces to Turn the Bearing Seat in the Leveling Socket Casting. The Rod Extending down from the Top of the Attachment Connects It with the Lathe Feed Mechanism, and Imparts a Traversing Movement to the Tool-head

How to Secure Fine Surfaces by Grinding

By H. J. WILLS, Engineer
The Carborundum Co., Niagara Falls, N. Y.

Sixth of a Series of Articles Describing the Factors Governing Fine Surface Quality and the Means by which This Quality Can be Obtained—The Present Article Deals with the Application of Dressing Tools

PREVIOUS articles of this series dealt with the general requirements for producing surfaces of fine quality by grinding, selection of the right type of grinding wheels for producing fine surface quality on different materials, and the effect of varying the work and wheel speeds. The discussion of wheel truing and dressing operations to meet various requirements, and the selection of diamonds and tools for these operations, begun in the preceding installment, is followed in the present article by instructions for the application of dressing tools.

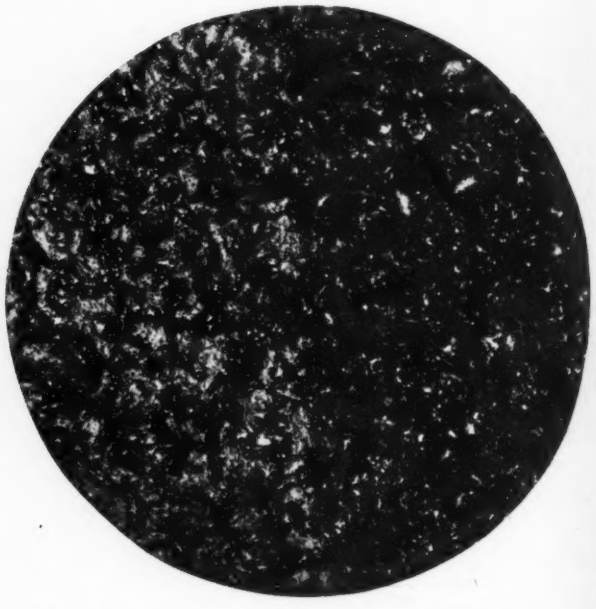
Next to the condition of the grinding machine, the most important factor in securing fine surfaces by grinding is the cutting condition of the grinding wheel face. Improper dressing of the grinding wheel face may be the cause of such faults as inaccurate work, chatter marks, spirals, grit marks, scratching, or discoloration and burning.

Proper dressing is an important factor in obtaining the maximum production rate. Since a wheel used for fine grinding is never wholly self-sharpening, its capacity to cut must be maintained by frequent dressing with the proper tools. If, in an attempt to increase production by reducing the amount of time devoted to dressing, a wheel is allowed to become dull, the resulting slow cutting action will often offset the saving in time gained by infrequent dressing.

Dressing at Predetermined Intervals to Maintain Uniform Quality of Finish

Grinding wheels should be dressed at intervals that have been determined by test to be the best for the specific wheel and job, regardless of whether the grinding wheel appears to require dressing. Incidentally, frequent dressing does not shorten wheel life; on the contrary, a wheel

Magnified Face of Grinding Wheel in which Left Half of View Shows Dull Abrasive Grains Loaded with Metal, while Right Half of View Shows Dressed Section with Sharp Abrasive Grains



Magnified Face of Grinding Wheel, in which Left Half of View Shows Abrasive Grains Dulled by Dressing with Dull Diamond, while Right Half Shows Sharp Grains Obtained by Proper Dressing

will last longer when dressed frequently, because a disproportionately large amount of material must be removed from the face when the wheel is allowed to become loaded or glazed.

In addition to dressing the wheels at predetermined intervals, tests should be made to determine for each job how rapidly the dressing tool should be traversed across the wheel face and how deeply it should penetrate to insure best results. The practice or standards thus determined should be made a matter of record, and strict supervision should be employed to make sure that the grinding machine operator observes them. The following case will illustrate the need for adopting this procedure.

A shop making a part for military planes on a high-production basis insisted that grinding wheels of exactly the same specifications as to grain size, bond, and grade were giving widely different results, both as to production and surface qualities. This claim was obviously erroneous, since grinding wheels are so carefully made and inspected that there is practically no chance that they will vary appreciably from their marked specifications.

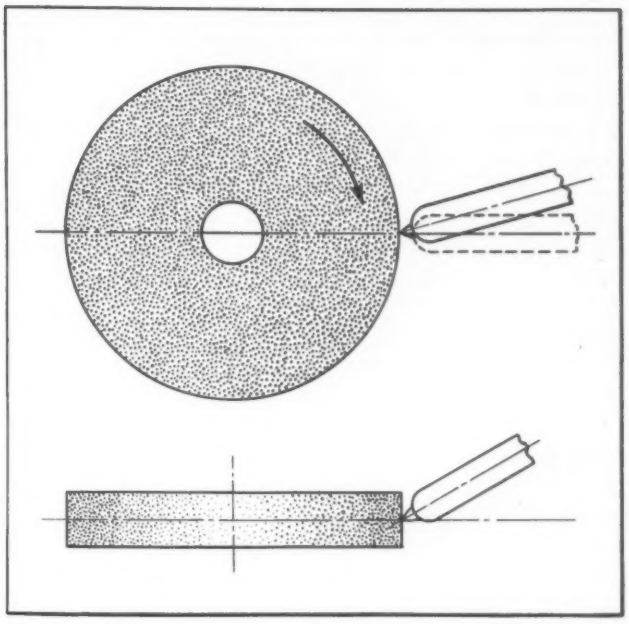
The trouble in this case, as expected, was found in the fact that the shop had adopted no standard practice for dressing the wheels. Some of the wheels were allowed to become very dull before dressing, and others were dressed with dull diamonds. In both cases, the wheels acted as though they were several degrees harder than those of exactly the same specifications that were properly dressed with sharp tools.

For fine grinding, dressing and truing are done with diamonds, abrasive-wheel dressers, and abrasive sticks. Before giving the procedure for each in detail, some general rules will be given that must be observed if accurate dimensions and fine surfaces are to be secured. Since star and disk dressing tools are not used for wheels that are to do fine grinding, they will not be considered here.

Grinding Wheels Must be Balanced before and after Truing

It is important that wheels be balanced both before and after truing. The methods used in balancing will be described in a later article. At this point, however, it is well to warn against the common practice of dressing or truing a wheel at speeds higher than those at which it will operate when grinding. A wheel that is in balance at normal speed may be out of balance at a higher speed. If trued at that speed, the wheel will be out of balance when grinding. Thus, the truing and dressing should be done at the operating speed, or at a slower speed.

Spiral lines on the work may be due to a dragging wheel edge, faulty centers, or a slight



Diagrams Showing how Holder of Diamond is Tilted in Vertical and Horizontal Planes for Dressing Grinding Wheel

spring in the wheel-spindle or work. This can be prevented by forming a radius on the wheel edges with a diamond or abrasive stick, and, if necessary, finishing with a piece of abrasive cloth or paper. This is especially desirable when using a fine-grit wheel for finish-grinding, except when the wheel must grind a square shoulder on the work.

The wheel face should not be dulled for the final finishing passes, as is sometimes done, because a burnishing rather than a cutting action will result, which, as stated in a previous article, produces a finish that has a fine appearance, but merely glosses over a poor surface.

The ways of a machine that has been in service for some time will become worn at certain spots. If the wheel is dressed at one of the unworn spots, the dressing or truing will not be satisfactory when the wheel is used at the worn operating position. Among other troubles resulting from this condition may be the serious one of a dragging edge.

The presence of abrasive grains which have been loosened but not removed from the wheel face is a common cause of scratches on the ground surface. To prevent this, the wheel face and slide should be scrubbed, after dressing, with a stiff brush, using clean water.

When to Employ Wet and Dry Dressing

If a wheel is used with a coolant when grinding, a coolant should also be used when dressing or truing. If the grinding is done dry, then the dressing should also be done dry. If a dry

grinding wheel is dressed wet, the wheel face will gum up when used for grinding. If a wet grinding wheel is dressed dry, cuttings resulting from dressing will adhere to the wheel face. A plentiful supply of coolant is required while dressing to wash away the cuttings.

Dressing tools that utilize a silicon-carbide wheel as the cutting element are held against the face of the grinding wheel at an angle of from 5 to 7 degrees from the vertical plane to produce a wheel face that will give a fine surface. A more open face, which may be desirable for the roughing and semi-finishing cuts in fine grinding, can be secured by increasing the angle, by using a coarser dressing wheel, and by increasing its penetration. By varying these factors, it is possible to secure a wide range of dressing effects from the abrasive-wheel dressers. If the same grinding wheel is to be used for roughing and finishing, it will have to be dressed differently for each operation.

Method of Dressing Grinding Wheel with an Abrasive Wheel

If the dressing is to be done with an abrasive-wheel dresser, and four operations, for example, will be required to build up the desired surface, the following procedure will be found effective: First, traverse the dressing wheel at the rate of about 40 inches per minute, feeding the tool 0.002 to 0.003 inch per pass. Second, after a few passes of the dresser, reduce the traverse rate to 20 inches per minute and use a feed of 0.001 inch for a few passes. Third, reduce the traverse rate to 10 inches per minute and use the same feed. Then make the final pass without any feed.

For the very finest surface finish, the same method is used, except that in all three stages of dressing, the wheels are kept thoroughly wet, with water as a coolant, and the angle between the grinding wheel and the dressing wheel is kept somewhat smaller, say about 3 degrees.

The dressing wheel should never pass out of contact with the grinding wheel for more than one-third of its width. If it should pass completely off the wheel, the dressing wheel will lose speed, and, on re-establishing contact, it will gouge into the grinding wheel. When the dressing wheel passes off the grinding wheel more than one-third of its width, the unit pressures are so increased that the wheel may be dressed with a taper at the edges, or the edges may even be broken. It is, however, permissible to allow the dressing wheel to lose contact in order to eliminate traverse marks on the grinding wheel.

It is necessary to keep the dressing wheel true; otherwise, it will not dress the grinding wheel properly or will give an irregular action, reproducing its own irregularities in the grinding wheel face. Unfortunately, this action is exaggerated in dressing a wheel for fine grinding, when the angle between the wheels is at a minimum. To true the dresser, it is set at an angle as large as 15 degrees, and a light cut taken across the face of the grinding wheel, which then acts as the dressing wheel.

A not uncommon trouble experienced with abrasive-wheel dressers is chipping and tapering of the dressing wheel edges. This fault is more likely to occur with wide-faced grinding wheels or with wheels having a hard grade of bond. The remedy is to equip the dresser with two wheels instead of the customary one, each 1/32 inch narrower than half of the width of the usual single wheel, separating the two wheels with a thickness of blotter material. The same angle is used, but it is essential that a copious flow of coolant be provided for the dressing operation.

The two-wheel dresser is especially suited to the dressing of wheels for fine finishing cuts, since it can be used with lighter feeds and slower traverse, which gives the grinding wheel a better face. The best practice is to use the abrasive-wheel dresser with a coolant supply; but since the operator often desires to watch the dressing action, he is likely to use the dresser dry. When he does this, both the dressing and the grinding wheels must be thoroughly flushed with water after the dressing operation has been completed.

Technique in Dressing Wheels with a Diamond

Perhaps the most important advice that can be given on the use of diamond dressing tools is to turn the diamonds frequently. This is necessary to insure presenting a sharp edge of the diamond to the wheel. A dull diamond will not completely crush the abrasive grains, as required to make them stand out above the bond, which is essential for fine grinding, but will partially break some and press others into the bond. These will later tear loose and roll between the work and the wheel, causing marks that make it impossible to produce a fine surface. Frequently, the truing or dressing of a wheel with a dull diamond causes the wheel to appear harder. To obtain the free-cutting quality essential for fine grinding, the wheel must be dressed with a sharp diamond.

The diamond itself must be located on a radial line of the wheel for the truing operation. Keeping the diamond at this point, the rear of the diamond-holder should be raised so that it makes an angle of from 3 to 15 degrees with the wheel radius. Then the rear end of the diamond-holder is moved to one side—the stone being kept in

its original position—until the holder makes an angle of 60 degrees with the face of the wheel. Raising the rear end of the holder vertically prevents the diamond from chattering or gouging into the wheel and thus being damaged. To make certain that this will not happen, it may also be advisable to drop or lower the point of the diamond 1/4 inch or less below the radial line of the wheel. The 60-degree angle in the horizontal plane enables the wheel to wear a broad sharp edge on the diamond, which will produce a dressed surface on the wheel that is free from marks of the truing diamond.

If the wheel is worn round or tapered and it is desired to true it to a straight face, the diamond should not be brought in contact with the wheel at the high point, as is usually done for ordinary grinding. Instead, if the job does not call for a very fine finish, the stone should be first brought close to the wheel, but not close enough to touch it. With a feed of 0.001 inch per pass, the truing diamond can then be traversed until contact is made with the wheel, after which the feeding and traversing movements can be continued until the wheel is properly trued and dressed. A diamond should never be "spotted" on the face of a fine-grit wheel.

Care should be taken to prevent grinding into the setting of the truing diamond unless the tool is especially designed to permit such use. In dressing a wheel for roughing cuts with a diamond tool, the diamond is passed rapidly across the face of the wheel with a feed of not more than 0.001 inch, one pass usually being sufficient. If the wheel surface is "loaded," it may be opened up by grooving it with deep diamond cuts at a very fast traverse, which serves to break down the wheel bond.

For finishing cuts with the same wheel, one pass can be made at a fast traverse rate, using a feed of 0.0001 to 0.00015 inch if the wheel is of soft grade, and 0.0005 inch if it is hard. The traverse rate is then reduced about one-half, and one or two passes made with a feed of 0.0003 to 0.0005 inch, following this with one traverse without feed. Dressing in this manner may cause slight spiral marks to appear on the first few pieces ground, but the finish will be good and the cutting action fast.

Dressing Wheel for Finest Precision Grinding

For the very finest grinding, a procedure similar to that described is followed by several passes of the dressing tool at lower feeds and slower traverse rates. As soon as the diamond shows signs of being cracked or burned, or of having flat spots, it should be replaced by a new one. Sharp-angled stones are wholly unsuitable for dressing wheels for fine grinding, since they are certain to mark the wheel.

The more common grinding faults caused by incorrect dressing practice and their direct causes may be summarized as follows:

1. Chatter marks, caused by a dull diamond or a tool that is not held rigidly, close to the wheel.

2. Fine spirals or threads on the work, which may be due to a cracked or broken diamond; too rapid dressing traverse; incorrect dressing tool angles; diamond not turned often enough; loose holder or loose stone in holder; too deep penetration of diamond tool; allowing tool to dwell in contact with wheel; starting dressing cut on face of wheel; uneven traverse of tool across wheel face; and failure to round off wheel edges. Sometimes these marks can be eliminated by making the final dressing pass in the direction opposite to the traversing movement employed for grinding.

3. Grit marks, which may be due to too coarse dressing. This trouble can be corrected by using less penetration and a slower dressing traverse.

4. Wheel loading or glazing, which usually comes from using a dull diamond, too slow a traverse, or too little penetration.

5. Inaccuracies in work, which may be due to the condition of the grinding machine, such as uneven wear on the ways at the points at which the dressing is done and the grinding performed.

* * *

Automotive Industry will Employ Disabled Veterans

At a recent meeting of the Manpower Committee of the Automotive Council for War Production, the latter was asked to recommend to its members that they employ disabled war veterans wherever possible on jobs that they can do efficiently and without risk to themselves and their fellow workers. A number of these men are already at work in the automotive industry. In almost every instance where discharged servicemen have been trained for specially chosen war jobs, the results, the automotive companies report, have been most satisfactory. Experience gained over a number of years in the employment of handicapped civilians has provided the automotive industry with a valuable background in placing servicemen who have been rehabilitated for home-front duties.

* * *

As a result of the war, the United States has added about 25 per cent to its manufacturing facilities. Manufacturing plants were valued at $60,000,000,000 in 1940. Plants to the extent of $15,000,000,000 have since been built. This represents the cost of the plants exclusive of the manufacturing equipment.

Multiple Milling Fixture for Cutting Special Bevel-Gear Pinion

By G. F. GROSCHKE
Schenectady Works, General Electric Co.

WHEN it became necessary to increase the production of a special bevel-gear pinion, a multiple milling fixture was devised and built to cut three of the pinions simultaneously, as shown in Figs. 1 and 2. One of the problems that had to be considered in designing the fixture was that of cutting seven teeth, so positioned that five and one-half teeth would be located on one side of the center slot, while one and one-half teeth would be on the other side. The fixture had to be fool-proof in operation to eliminate the possibility of spoiling work by incorrect indexing.

The bevel-gear pinion has a pitch diameter of 0.666 inch, with a gear face length of 3/8 inch, and hubs of different diameters on each side of the pinion. The larger, or 1/2-inch diameter, hub on the back end of the pinion is 0.767 inch long, and has a slot 1/16 inch wide milled through its center for a depth of 1/2 inch.

It required four minutes to cut one pinion singly, using a regular dividing head. With the new multiple fixture, three pinions are cut in 1 1/3 minutes, which represents a 900 per cent speed-up in the operation.

The fixture is built on a plate having keys for mounting on the milling machine table. The main operating mechanism is enclosed in a steel box, at the rear of which is a removable chip guard. This gives access to the inside mechanism if required, although the only parts that may need replacing are two tension springs, the functions of which will be described later.

All parts operate from a supported shaft that passes through the center of the fixture and is inclined at an angle of 8 degrees 6 minutes from the horizontal, which is the dedendum angle of the gear. This shaft is turned manually by means of a small handwheel pinned to the end of the shaft that extends through the chip guard. Assembled on the shaft in order are a specially designed ratchet, a small spur gear, and a holder or sleeve made to a sliding fit for the 1/2-inch diameter hub of the pinion to be cut. At the correct distance each side of the spur gear, two similar spur gears are mounted on two small shafts, the two latter gears meshing with the gear on the main shaft. Each shaft terminates in a sleeve, thus enabling three bevel-gear pinions to be inserted and cut at one time.

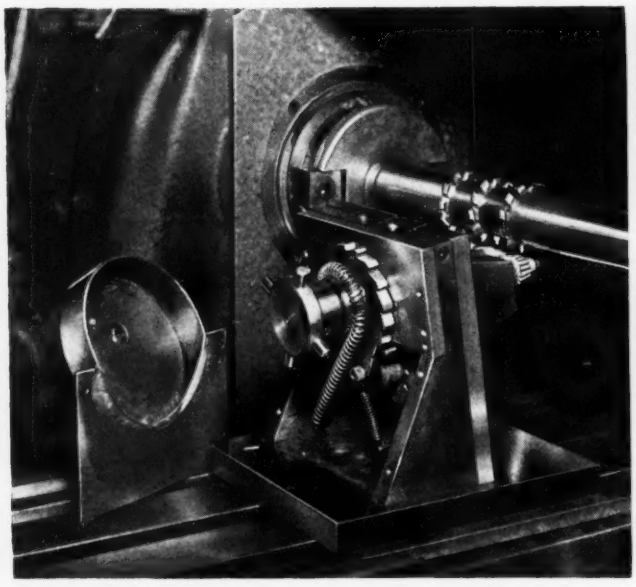


Fig. 1. Multiple-spindle Bevel-pinion Cutting Fixture with Rear Cover Removed to Show Indexing Ratchet Mechanism

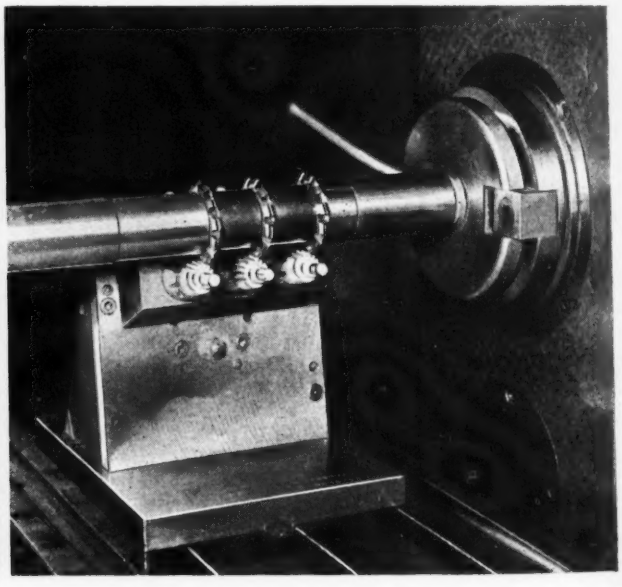


Fig. 2. Front View of Fixture Shown in Fig. 1 with Three Cutters Simultaneously Milling the Teeth in Three Bevel Pinions

While being machined, the bevel-gear pinions are held securely by cutter pressure and a special pin. The sleeves at the end of the shafts protrude 3/4 inch beyond the front of the fixture. A pin extending through each sleeve exactly fits the slot in the hub of each pinion. These pins are located 1/2 inch from the mouth of each sleeve, the distance corresponding to the depth of the slot in the hub of the pinions. It is this pin that automatically aligns each bevel-gear pinion so that the required seven teeth are correctly located in relation to the hub slot.

The ratchet controlling the number and position of teeth on the work was cut with eight teeth, so that the pinions would have seven teeth as required. At the end of the last tooth, the ratchet is cut away in a manner that permits a dog to be pulled back by its spring, thus eliminating possible error by attempting to index manually for an additional tooth. The dog is located in the center of the fixture on a mounting just below the main center shaft. Two tension springs, one each for the ratchet and dog, having one end attached to the parts and the other end anchored to the bottom and side plates of the fixture, are used to actuate the fool-proof mechanism. A set-screw acts as a stop upon release of the ratchet after cutting the seventh and last tooth.

Thus, in operation, three bevel-gear blanks are locked in position in their respective sleeves, and the graduations on the hub of the handwheel indicate the starting position for the first tooth and for each successive one. As each tooth is cut, the handwheel is turned or clicked one notch, which increases the pull on the tension spring. The dog prevents the handwheel returning to its normal position until the seventh tooth has been indexed and cut. Following intentional release or an attempt to index for an extra tooth, the dog, having no holding point, because the ratchet has been under-cut, is pulled back by its spring. The ratchet spring unwinds from the shaft and the handwheel automatically returns to its starting position.

* * *

Production of Machine Tools

According to information authorized by the War Production Board, the shipments of machine tools for July—the last month for which complete statistics are available—totaled $97,428,000. Net new orders for machine tools (total new orders less cancellations) amounted to $28,795,000—the equivalent of an annual rate of approximately $345,000,000. The backlog of unfilled orders at the end of July was $441,311,000. This backlog, at the present rate of shipments, will take about four and a half months to fill.

Suggested Changes in the Renegotiation Law

In a hearing before the House Committee on Ways and Means of the Congress of the United States on amendments or repeal of the Renegotiation Law, September 14, J. F. Lincoln, president of the Lincoln Electric Co., Cleveland, Ohio, presented a statement in which he emphasized that five people on the Price Adjustment Board have the power, at their whim, to destroy any industry in the United States. They have already laid the groundwork for such destruction in many cases. There is no recourse to the Courts in their decision. Such powers have never before been given to any group of men in the history of the United States. The fundamental principle of our Republic—recourse to the courts for justice—has been eliminated.

As the law is administered by the Board, efficiency is penalized, inefficiency is rewarded. No efficient organization can escape, and no organization that is sufficiently inefficient has yet been renegotiated, said Mr. Lincoln. Renegotiation boards have claimed a saving of $4,000,000,000. This is a gross deception, because all but $400,000,000 has already been captured by the present tax law. Even if the amount claimed by the boards had been recovered, it has been lost many times over by the inefficiency forced on industry by renegotiation.

According to Mr. Lincoln, the lagging of the war effort, almost daily reported by the War Production Board and the Administration, is the direct result of this interference. The Renegotiation Law should be amended.

Mr. Lincoln suggested the following changes in the Renegotiation Statute: "The provisions of this section shall not apply to any contract or sub-contract for standard commercial products, provided such products (1) have a general peacetime use in industry; and (2) were made or sold by the contractor or sub-contractor prior to January 1, 1941, pursuant to a standard published price list and are now being sold as the same product pursuant to a standard published price list; and (3) are manufactured or sold by more than one independent manufacturer as a competitive product; and (4) are sold at standard published list prices equal to the lowest standard published list prices of any manufacturer or seller of the same product; and (5) were, at the time when the contract or subcontract was made, subject to a ceiling price fixed by a Federal Governmental Agency."

* * *

There are now 3,000,000 Federal employes, apart from the Armed Services. Without doubt, many are in non-essential jobs and of draft age.

Editorial Comment

One of the fundamental principles that are overlooked by many who advocate Governmental action for the solution of economic difficulties is that wealth and capital are produced by individual effort and initiative, and never by Government. When, as has been the case recently, the Government invests capital in private enterprise or in plants of its own, the money must be obtained by taxation of, or by borrowing from, wealth-producing private enterprises and individuals.

Enterprising Men, Not Government, Provide Money to Pay Wages

Government, as such, creates no wealth and no capital, and has nothing to invest except what it obtains from those who create capital. This being the case, it is obvious that in times of peace, investment in productive enterprises should be left to the organizations or individuals who produce the capital to be invested. Since they once created it, they are likely to know more about how to handle such investments in such a way as to create more wealth— that is, more production—for the benefit and welfare of the entire population than an inexperienced Government office-holder.

Statistics indicate that an average investment of over $8000 is required to provide employment for each worker in a manufacturing industry. In other words, somebody had to produce and save that $8000 before he could provide employment for someone else. As the number of people for whom jobs must be provided increases—and after the war this increase will be very marked —the amount of savings or capital that must be invested in industry will also increase. If we are to provide employment for all our people, we must also have employers capable of raising the capital to provide employment.

Government Should Encourage, Not Discourage, Men Who Create Jobs

The part the Government should play in this process is simply to encourage, rather than discourage, the employment of savings in industrial enterprises. Our methods of taxation must be such that industrial companies are permitted to retain part of their earnings. How else can they provide for the employment of present war workers and of returning servicemen when the war is over and industry must reconvert to peacetime production? To provide the setting for full employment when peace comes, we need intelligent, broad-gaged Government policies relating to industry, labor, and taxation.

Induction heating equipment is destined to become one of the important facilities in the modern machine shop. The advances that have been made during recent years in the application of induction heating in machine shop operations are remarkable. Steel parts are heated for hardening or other heat-treating operations almost instantaneously. The heat is uniform and can be localized. When quenching is required, it can be done instantaneously.

Induction Heating, A New Effective Tool of Industry

Induction heating methods have already been applied to a large extent in the production of many kinds of war materials, especially in heating shells. The earlier applications of heating crankshafts and other automobile parts in this manner are now well known. The field, however, is constantly broadening; and after the war, it is likely that induction heating equipment will be as generally applied in modern machine shops as the more highly developed types of machine tools are now.

We hear a great deal about planning, as if planning were something new, and especially as if it were something invented in Washington. As a matter of fact, all the achievements of industry in the past have been due to planning. The very existence of industry is built on the conception of planning, and the most capable planners are our industrial leaders and their executives and engineers. Furthermore, the planning done by industry has not been based on dreams, but on hard, practical facts; and while imagination has entered into this planning, it has been an imagination tempered by knowledge and experience.

"Planning" is Not a New Idea Invented by Economists

There Must be No Let-Up in Industry's War Effort

THE production of war equipment in American factories for some months has not been as great as it should have been. Some of the reasons for this are within the control of the War Production Board, but others are not.

One of the fine qualities of the American people—optimism—has for the moment become a dangerous factor. The great majority of our people do not realize how serious the war situation is. Victory is not yet in the bag, and wishful thinking will not place it there. There must be realism on the part of all engaged in industry—management and workers alike—and on the part of the American people generally. We must not fool ourselves by planning as if the war would end soon. The War Department must do the planning; its plan is to fight through to Berlin and Tokio, and it must decide what is required to gain those objectives.

Management and labor, in many instances, seem to think that we have reached the peak of the required war production. That decision, however, is not in their hands. It must be made by the leaders in the Armed Services. Industry's job is to meet the schedules laid down; and if we are to continue to be successful in our war effort, industry must meet them. It is not always easy, but it is our job to see this business of war through to a successful finish. The home front has a duty to perform in finishing the fight, just as much as the Armed Forces.

Everyone who has anything to do with the production of war materials should realize that every single day that we can shorten this war by overwhelming quantities of war equipment means the saving of thousands of lives in our Armed Forces, not to speak of material savings in our resources.

Management and Labor have Each an Important Part to Play

Throughout the entire emergency, there have been some serious examples of the selfish attitude of labor; there have also been examples of the selfish attitude of management. There are some cases where neither management nor labor has cooperated wholeheartedly with the war effort.

The chief problem is no longer raw materials. It is a production equal to the combined ability of management and labor. There is still room for improvement in the efficiency of both parties to the war production program and a need for better utilization of labor. Especially is there a crying need for cutting out artificial restrictions on production, such as are fostered by many union rules.

It is gratifying to record that in many instances labor leaders, when appealed to, have responded by abrogating certain time- and labor-wasting regulations for the duration of the war. Unfortunately, there are still many who look upon this war as an opportunity to fortify their position as labor leaders, and to obtain concessions for labor that are not justified in this national emergency. There are those connected with the War Labor Board who feel that if cooperation cannot be obtained, contracts must be taken out of certain areas. The Pacific Coast, in particular, because of its many new industries, requires the highest type of efficiency of management and a cooperative spirit on the part of labor.

Management Should Report Any Interference with Production to War Production Board

Management is responsible for fulfilling accepted orders and schedules. There is no excuse for making promises that cannot be fulfilled. Management must have the ability to make allowance for emergencies—that is what capable management is for. If Congress, through the laws it has passed—particularly one-sided labor legislation—and the Administration, through red tape and non-enforcement of laws intended to prevent production hold-ups, hamper management in its production efforts, industry should voice its protest courageously. The attention of the War Production Board—of Donald Nelson himself—should be called to any interference with production caused by the red tape of Government agencies or by labor union regulations.

While the Board has no power to abrogate union rules or contracts entered into between management and labor that hamper production, under the laws passed by Congress, the Board wants to know about such restrictions. It may be able, by persuasion, to have the obstructions withdrawn, and it can also call the attention of the Administration and Congress to the effect of measures that are obstacles to the war production effort.

The industrial plants of America can produce

more per hour, per day, per month, than has been done. Production would be aided by removing many of the "feather-bed" union rules that have become such an obstacle to efficiency. As matters now stand, these rules are often included in collective bargain agreements, and can only be repealed by voluntary action. It is not possible to hope that they will be repealed by legislation, because, unfortunately, Congressmen, for reasons of their own, are afraid of offending powerful pressure groups.

Only one way, therefore, is now open to the management of industry, as well as to the governmental agencies responsible for war production. That road is to eliminate rules that obstruct production by voluntary agreements with fair-minded labor leaders. In some fields, there have been no-strike agreements which have been scrupulously lived up to.

It is stated on good authority that millions of man-hours could be saved annually in the war effort if the boilermakers' union would modify some of its restrictive rules. Recently, an agreement was made with a union controlling welding in the shipbuilding industry. There was a rule that made it necessary for a welder to stand idle while another worker performed his job, and for the other man to stand idle while the welder performed some tack-welding for which a highly experienced welder was not required. When, by voluntary agreement, this rule was abrogated, the welding in one shipyard was increased from 20,000 to 39,000 feet per day with the same number of welders.

Incentive Methods of Pay Should be More Generally Used

The introduction of incentive systems of pay would aid greatly in increasing production; but there are instances where both management and labor leaders have objected to incentive payment systems; and stop-watch observations and time studies are forbidden on some Government work. As a rule, the workers themselves are not against incentive payment systems, but the labor leaders are, because the question of the earnings of the workers is then out of their hands.

It seems hard to believe that, in these trying days, there are men so lacking in appreciation of the nation's needs—so lacking in fundamental patriotism—that they are not willing to suspend rules hampering production for the duration of the war. Practically all other classes have had to accept restrictions, and many enterprises have been put out of business by the war. Those who have sacrificed ask themselves, "Why should labor organizations in the war industries be exempt?"

It is important that any incentive system adopted include the supervisors; otherwise, the result would be that many of the machine operators and bench workers would earn more than the supervisors, and this, in turn, would create an unfavorable condition.

The Problem of Absenteeism

Absenteeism is responsible for a considerable reduction in output in many plants. In some industries, it runs as high as 10 per cent. In one shipyard, the average is 12 per cent and among welders as high as 25 per cent, in spite of the fact that welding is a bottleneck. The coal strike is held responsible for the non-production of 90,000 tons of steel.

There seem to be only two cures for absenteeism: One has been termed "heart and conscience"; the other is "work or fight." There has not been enough fortitude in Congress to pass an effective law to take care of the second of these alternatives, nor has the Administration used the powers it already has to meet this condition.

Those who have seen what the people of Great Britain are doing say that we are not equaling them in production. In many fields, our plants do not produce as much per man-hour as is done in England. Absenteeism alone shows that we are not taking our job seriously.

The heavy turnover of labor presents another serious problem. In some shipyards, it has been found necessary to hire five men in order to keep one. The labor "freeze" order has not proved effective. It has not worked very well—possibly it has not been administered intelligently.

It is hoped that it will not be necessary for Congress to pass a universal service act, but it might come to this if it is not possible to obtain production results on a voluntary basis. In that case, it would be highly important to have outstanding local business men and industrial leaders allocate labor to essential industries. Politicians and lawyers should be kept out of the picture.

Needed Changes in the Work of Government Agencies

Most of the leading men in Government agencies agree that there is too much paper work in Washington and too much paper work required of industry. One of the difficulties is that, in many cases, information, the need for which has passed, is still being collected. This paper work will doubtless be reduced in the future. In one instance, a Government bureau sent out 22,000 questionnaires, receiving 10,000 replies. These replies were all in hand about June 20, the information received was tabulated

by August 10, and a voluminous report prepared —several inches thick, in large folio size—too late to do anybody any good (even if it ever had been of any value). No one in Washington, according to good authority, has looked at it since it was compiled.

In conclusion, it may be said that in many cases, management feels frustrated in its efforts by the conditions that have been created by the Government itself—by Congress and by the Administration. Still, since these conditions cannot be remedied overnight, they will have to be looked upon as hurdles to be jumped. Management must accept the difficulties placed in its way and do a creditable job in spite of them. American industry has always proved itself able to overcome difficulties, and this is no time to forget that tradition, even though it may seem that the Government should have had the foresight and courage to remove the obstacles to more efficient war production. American industry must show what it is capable of doing in spite of its troubles.

Of course, Congress could do things to change matters for the better; the Administration likewise could be expected to do a better job. But because the Government is not perfect, that is no reason why industry should not do its very best. The War Production Board cannot change the laws of the country or the conditions created by administration policy, nor can industry; hence there is but one choice: Industry must carry on its job in spite of all the hurdles placed in its way.

Robert M. Gates, New President of A.S.M.E.

ROBERT M. GATES, president of the Air Preheater Corporation, New York City, has been elected president of the American Society of Mechanical Engineers for the year beginning with the annual meeting next December.

Mr. Gates was born in Iowa in 1883. He was educated at the Manual Training High School in Indianapolis, Ind., and at Purdue University, where he received the degree of bachelor of science in mechanical engineering in 1907. After his graduation, he was first associated with the Browning Co., Cleveland, Ohio, after which he practiced as consulting engineer for three years until 1912, when he became associated with the Thew Shovel Co., Lorain, Ohio. In 1918, he became eastern manager, with office in Philadelphia, for the Lakewood Engineering Co., Cleveland, Ohio. In 1922, he became associated with the Superheater Co. of New York, of which company he became vice-president, holding the same position with its affiliate, the Combustion Engineering Co.

Mr. Gates has participated in the design and construction of fuel-burning and steam-generating equipment, including boilers, stokers, pulverized-coal equipment, economizers, air preheaters, and superheaters for stationary, railway, and marine service. His work has also included a wide variety of heavy equipment for the process industries. Outstanding among these installations are the world's largest high-pressure boilers, each producing over 1,000,000 pounds of steam per hour.

Mr. Gates has long been active in the affairs of the American Society of Mechanical Engineers, of which he became a member in 1918. He served as a manager from 1928 to 1931, and as a vice-president from 1931 to 1933. He has also been a member of various standing committees, including those on Meetings and Program, and Professional Divisions. He has served as a member of the War Production Committee of the Society since 1942, and is also serving as chairman of the War Production Clinics which the Society, at the request and with the assistance of the War Production Board, has been conducting for more than a year in industrial centers throughout the country.

Mr. Gates has given much time to counseling junior and student members of the Society. His keen interest in the problems of young engineers and engineering students is probably attributable to the fact that he supported himself during his entire education, including the high-school period, when he sold tickets in the Indianapolis Union Station. Aside from his engineering activities, he has found time to take considerable interest in civic affairs.

Two Die Designs that Won Awards

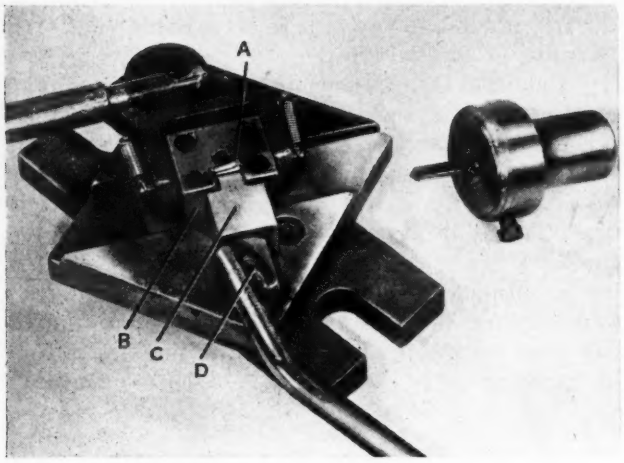


Fig. 1. Punch and Die for Piercing Elongated Hole in Electrical Terminal A

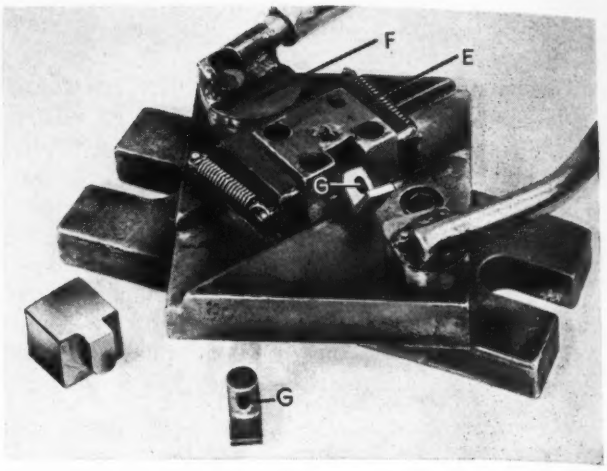


Fig. 2. Die Shown in Fig. 1 in Open Position after Piercing Elongated Hole G

BY developing the punch and die shown in Fig. 1 for piercing elongated holes, such as shown at *G*, Fig. 2, in cast-copper branch terminal connections, Joseph Mizak, a toolmaker at the General Electric Bridgeport Works, helped speed production on an important piece of electrical equipment and earned an award of $1200 through the company's suggestion system.

Previously, the elongated hole was produced by drilling a 3/16-inch hole in the connector and then elongating the hole to 5/16 inch with an end miller—a method that frequently left burrs almost an inch long, which had to be removed by filing. The chief purpose in developing the punch and die here described was to minimize the burrs. The method was not only successful in accomplishing this purpose, but also proved to be a faster and simpler means of doing the job. Use of the piercing method for the job is particularly interesting because the diameter of the hole is smaller than the thickness of the material pierced—1/2 inch—and was possible only because the material was soft cast copper.

The work *A*, Fig. 1, is set in the die *B* and locked by a pusher-block *C*, operated by the lever-actuated cam *D*. The hole is pierced in one stroke of the press by the piercing punch shown at the right. After the work is pierced, the operator rotates the cam-locking lever to release the pusher-block, and removes the work by rotating lever-operated cam *F*, Fig. 2, which actuates a U-shaped spring return ejector *E*.

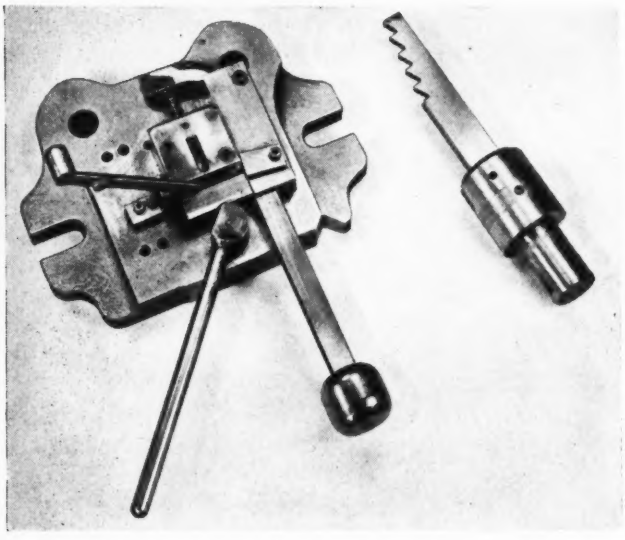


Fig. 3. Broaching Punch and Die for Slotting Ends of Copper Bus Bars

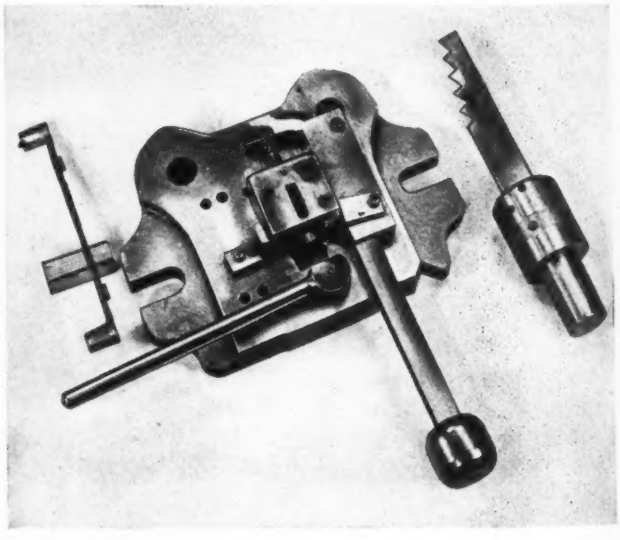


Fig. 4. Broaching Punch and Die with Work Removed from the Die

The success of this method led the toolmaker to develop a second die, shown in Fig. 3, for another job of a similar type. This is a broaching punch and die for slotting a cast-copper bus bar. The milling operation previously employed left burrs that had to be removed by hand-filing. The operation of this die, also shown in Fig. 4, is similar to the first one described. The work is set and locked in the same manner, and removed by a spring return ejector. The slot is 5/16 inch wide, and is punched through a piece 11/16 inch in diameter. A five-tooth broach is used because of the short stroke of the press available for the work. If a long stroke press were available, the broach could be designed with more teeth, thus permitting a lighter cut for each tooth. The five-tooth broach, however, is satisfactory, and leaves no burrs.

High-Capacity Ball Reciprocating Bearings

By S. R. THOMAS, Chief Engineer
Bantam Bearings Division of Torrington Co.
South Bend, Ind.

THE term "ball reciprocating bearing" is used by the manufacturers of these bearings to designate a bearing capable of both rotation and axial reciprocation. Obviously, such a bearing cannot have definite ball tracks or grooves. Sometimes rotation only is required, and sometimes axial reciprocation alone is desired. For this reason, the outer raceway is the inside of a hardened and ground cylinder, while the inner race is either the outside of a cylinder or the surface of a hardened and ground shaft. The balls are placed between the two surfaces and are generally retained in the pockets of a metal cylinder serving as retainer.

It is well known that a ball pressed against a flat plate, especially against a surface the curvature of which is opposite to that of the ball, has less load-carrying ability than the same ball placed in a groove similar to that of the conventional Conrad type ball bearing. The load-carrying capacities in the two cases have a ratio in the neighborhood of 1 to 10.

In order, therefore, to secure the greatest load-carrying capacity in a ball reciprocating bearing for a given size, we are left with but few alternatives. One of these is to provide the greatest possible hardness and uniformity of parts, in view of the fact that all contacts are minute ellipses of very limited area, and the harder the parts the greater the unit pressure that can be applied. Another solution is found in accuracy of manufacture and proper design to distribute the load uniformly over the bearing. A third alternative is the subject of this article. By finding a means of increasing the number of balls in the same size bearing, a proportionate gain in capacity is obtained. If it is possible to install twice the number of balls, the capacity of the bearing is doubled.

The Bantam Bearings Division of the Torrington Co. recently was granted U. S. Patent No. 2,316,468 on means for increasing—in fact, doubling—the capacity of this type of bearing. The usual ball cage is a cylinder of bronze, steel, or aluminum drilled to form ball pockets of the greatest number per inch of cylinder length. The new Bantam construction consists of spirals of balls separated by coils of a specially formed helical spring, as shown in Fig. 1. The section of the spring wire may be triangular, round, square, or rectangular; but by making it in the form of an hour-glass, not only facilitates loading the balls, but retains them between the races during shipping and installation. This construction is less expensive than the conventional type of retainer, both from the material and weight standpoint, and from a fabrication point of view.

In Fig. 1, it will be noted that the balls are restrained from end exit by the formed ends of the helix. When this bearing is used in rotation

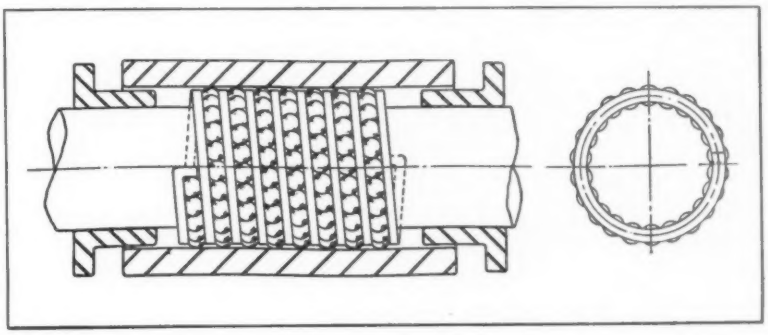


Fig. 1. Bantam Construction of Ball Bearing Capable of Both Rotation and Axial Reciprocation

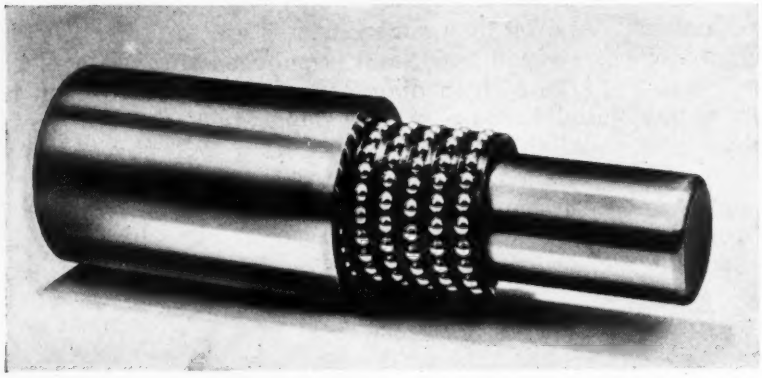


Fig. 2. Ball Reciprocating Bearing Ready to be Assembled

only, the helix of the retainer so positions the balls that each has its own special path.

In one test bearing, the pitch of the helix was 0.250 inch; each row contained twenty-two 3/16-inch diameter balls. Therefore, allowing no end play, each ball had a path (in rotation only) 0.0113 inch wide. Each path of the stationary race was thus loaded to maximum only once in about two revolutions, whereas in a grooved-race radial bearing with twenty-two balls in line, the maximum load on the stationary race would occur twenty-two times in two revolutions.

Ball reciprocating bearings are often used to operate in an axial direction only, and in such cases a large number of axial paths exist. The most common usage of this type of bearing is, however, in both reciprocation and rotation. When so used, the tracks of the numerous balls make intricate and overlapping designs, often covering every particle of the surfaces of both raceways. In this type of bearing, it is desirable to hold the diametral clearances close; a slight preload is permissible.

As a general guide for the capacity of this type of bearing, it may be said that the static capacity is dependent upon the number of balls, the diameter of the balls, and the radius of curvature of the inner race. Expressed as a formula,

$$C_s = KND^2F$$

in which

C_s = static capacity, in pounds;
N = number of balls;
D = diameter of ball, in inches;
F = curvature factor; and
K = constant = 200.

The constant K is derived from laboratory tests in which balls were loaded on hard flat steel plates up to the point where any greater load would cause "Brinelling" (indentations in the steel plate). The value of K is 200 for plates and balls of 60 Rockwell C hardness.

The value of the curvature factor F is given below. The value is found by determining R, the ratio of the inner race diameter to the ball diameter.

R	4	6	8	10	12	14	16
F	0.820	0.875	0.907	0.930	0.945	0.957	0.965

Values of F not given above may be interpolated.

To obtain the capacity C_r, in rotation only, the values of C_s may be modified by using $K = 100$ and applying speed factors. (These speed factors may be obtained from Manual No. 14, published by the Bantam Bearings Division of the Torrington Co., South Bend, Ind.)

For both rotation and reciprocation, the capacity is little affected by the rate of reciprocation, as long as it is not excessive. Other factors that influence the capacity of this type of bearing are deflection of parts making up the assembly, accuracy of workmanship, over-travel of load, and lubrication.

Some of the devices in which this type of bearing is used are taper measuring instruments, engine governors, welding machine guides, printing press vibrator shafts, cloth-cutting machines, grinding-wheel dresser shafts, spool-winding machines, propeller-testing equipment, buffing machines, stem grinding and polishing spindles, wire-brushing machines, rotary-tool pipe cut-off spindles, airplane landing gear, inking rolls, sheet-polishing machines, gear grinders and lappers, paper-coating machines, remote-control gear-shift mechanisms, and hydraulic welding machines.

As the use of this type of bearing has occasionally been limited by its relatively low capacity, its field of usefulness should be greatly increased by this improved design which permits, in general, of doubling the load-carrying ability of this type of bearing.

* * *

Use of the Vibration Meter in Machine Shops

In the plant of John Bath & Co., Worcester, Mass., manufacturers of precision taps, vibration in a grinding machine had been causing a large number of rejections. An investigation made with the aid of a General Electric electronic vibration-velocity meter revealed that a set of gears in this machine, apparently in good condition, caused the vibration. By replacing the gears, the difficulty was eliminated. In the same plant, the vibration meter was also found of value in detecting low-vibration areas in the shop, thus aiding in placing new equipment where there would be a minimum of vibration.

Condensed Review of Some Recently Developed Materials—1

Arranged Alphabetically by Trade Names

Class of Material	Trade Name	Properties	Applications
Lay-out Dye	**Acme Quality Industrial Finish**	A purple semi-transparent lay-out dye, extremely fast in drying. Stock so coated can be scribed with sharp-pointed stylus or similar tool. Dye is quickly removed with denatured alcohol.	Designed to facilitate the making of sharp clear lay-outs on sheet metal.
Welding Glass	**Alubro-Weld**	A blue glass compounded to filter out injurious rays of light. Has higher visible light transmission than ordinary blue glass; blocks out ultra-violet rays entirely; greatly reduces transmission of infra-red rays.	Specifically recommended for aluminum and bronze welding, glass work, instrument making, and other operations where sodium yellow glare is encountered.
Protective Coating for Repairing Tin Surfaces	**Amco Metallic Coating Powder, Brand K**	A compound with a melting point lower than that of tin. It blends readily with tin coatings and is electro-positive to iron and steel, affording protection against rust and corrosion.	Can be used wherever tin coating has been damaged or worn away. Suitable for use on food container surfaces that do not come in direct contact with food.
Aluminum Bronze	**AMS-4640**	An extruded high-iron, high-nickel aluminum bronze available as Grade 45-22 of Ampcoloy series. Has tensile strength of 95,000 to 105,000 pounds per square inch; yield strength of 50,000 to 55,000 pounds per square inch; and hardness of 207 to 229 Brinell.	Used in aircraft production.
Weld Spatter Compound	**Anti-Spatter**	A non-inflammable, non-toxic compound. Can be readily applied to joints to be welded and the metal surfaces surrounding them.	Developed to prevent the adherence of weld spatter to metal areas surrounding welds.
Aluminized Sheet Steel	**Armco**	An aluminum-coated sheet with mild-steel base combining corrosion resistance of aluminum and strength of steel. Withstands temperatures up to 1000 degrees F. without discoloration. Aluminum coating will not peel or flake off in moderate drawing operations.	Present aircraft applications include fire walls and air-intake filters.
Alkali Silicate Finish	**Armor-Vit**	An alkali alumina-silicate finish that is insoluble in boiling water and is highly resistant to many acids, salts, and alkalies. It has high impact and abrasion resistance and is able to withstand severe thermal shock.	Suitable as a protective coating for a variety of metal products subject to severe corrosion.
Low Phenolic Content Plastics	**BM-15983 BM-16044 BM-16325 BM-16499**	Low phenolic content plastics which can be used for many purposes where it is not necessary to meet exacting Government specifications.	BM-15983 black, BM-16044 brown, and BM-16325 black have been developed for uses formerly requiring general-purpose phenolics; BM-16499 is suitable for work requiring high impact resistance.
Blackout Coating	**Carbozite Blackout Black**	A non-reflective, completely opaque blackout compound which adheres firmly to glass, is impermeable to moisture, and is unaffected by smoke, soot, extreme heat and cold, or sunlight.	Applied to exterior surface of windows by brushing or spraying. Is readily removed with gasoline, kerosene, or any light petroleum solvent.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Pattern Repair Material	**Celastic**	A double-nap cotton flannel impregnated with cellulose nitrate and a fire retardant, readily formed into any shape when wet with solvent. Retains shape on drying. Adheres readily to wood, metal, and other materials.	Used for quick repairs and alterations for patterns of metal castings. When so used, can be sanded and shellacked to a smooth surface.
Magnesium Fire Extinguisher	**Cend-Ex**	A granulated coal-tar pitch conforming to standards set by U. S. Bureau of Mines.	For use in extinguishing magnesium fires or incendiary bombs.
Low Melting Temperature Alloy	**Cerrosafe**	A mixture of bismuth, lead, tin, and cadmium weighing about 0.35 pound per cubic inch, which is completely molten at 190 degrees F. Slight shrinkage during solidification and cooling partially compensated for by subsequent growth. For surface protection, can be applied with low-temperature spray gun.	Suitable for proof-casting of cavities such as molds, gun chambers, and forging dies; for accurate models for engraving machines where stylus pressure is low; and for protecting wood core molds and patterns.
Manganese Alloy	**Chace Manganese Alloy No. 772**	A new manganese-base alloy containing over 70 per cent manganese. Has an electrical resistance of 1050 ohms per circular mil foot. Its thermal expansion rate is considerably higher than that of any other strong alloy—about twice as high as for steel. Its thermal conductivity is only 2 per cent that of copper.	Numerous applications are expected in the field of temperature-actuated electrical controlling devices.
Protective Coating	**Chempruf**	Protective coating designed to withstand attack by any acid or alkali at temperatures below 300 degrees F. Available in liquid form for brush application and as a plastic for heavy-duty service. Compound starts to soften at 300 degrees F. and melts at 510 degrees F. Not recommended for contact with mineral solvents, oils, and greases.	Average of four coats required for protection. Useful in the protection of plating and acid tanks, fume ducts, storage and processing tanks, and other surfaces, including ceramics exposed to destructive agents.
Plastics	**Colonial V**	A series of three plastics which, when used in place of rubber, are claimed to provide higher resistance to aging, abrasion, sunlight, oils, gasoline, and acids.	Available in the form of tubing, pipe, mono-filaments, multi-filaments, rod, shapes, general extrusions, tapes, injection moldings, etc.
Rust and Scale Removing Compound	**Corrosol 26**	Used in cold solution on metal surfaces. Surfaces so treated are not susceptible to corrosion, but are left in a clean passive condition.	Used to remove rust, scale, and burn marks from machine parts.
Rubber and Leather Substitute	**Cotton-leather**	Multi-ply fabric chemically treated to increase its density and durability, and surface-treated to give it a flexible leather-like nature.	Designed for use as a substitute for rubber and leather in such applications as facing belt-driven pulleys, pipe, hose clamps, shock-absorbing blocks, heavy shim stock, and anti-squeak webbing.
Rifling Oil	**Cut-Max**	An oil of unusually light body which flows freely through small orifices; is said to be especially suitable for high-production operations.	For use in hydraulically operated rifling machines.
Degreasing Solvent	**Cyclodiene Hydrocarbon**	A non-aqueous degreasing solvent which, when applied by dipping, leaves a thin protective rust-inhibitive film that evaporates in about twenty minutes. The material is non-inflammable and non-explosive.	For use in connection with plating, painting, Parkerizing, anodizing, and other finishing processes.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Babbitt Substitute	**Defender**	A lead-base bearing metal suitable for use in place of tin-base babbitt.	Recommended where bearings are subject to shock, as in internal combustion engines, trap-rock crushers, and sifter machinery.
Lubricant for Drawing and Stamping Nickel Alloys	**Diglycol Stearate S**	A white wax-like solid, dispersible in water. Melts at 51 to 54 degrees C. Fires off at any annealing temperature (above 400 degrees F.) in an atmosphere of oxygen or hydrogen.	One per cent solution used for drawing, stamping, and forming nickel alloys. Smaller concentrations used as coolant in stamping operations.
Penetrating Agent	**Dresinate**	A finely divided, uniform powder that greatly increases the detergency of alkaline cleaning solutions. The emulsifying action helps to get oily foreign material into suspension for removal.	Suggested for use in conjunction with trisodium phospate, sodium metasilicate, caustic soda, soda ash, borax, and other alkaline detergents for cleaning metal prior to rustproofing, lacquering, painting, or plating.
Magnesium Fire Extinguisher	**duMag**	Dry fire-extinguishing powder for extinguishing magnesium and incendiary bomb fires.	Powder is applied directly to burning magnesium from container or with scoop or shovel.
Luminous Paint	**Durad Luminous Paint**	A paint that reradiates light for twenty hours after exposure to daylight or electric light for a few minutes. Produces a flat white finish or glossy finish with special top coat. Contains no toxic materials.	May be used indoors with special primer and thinner supplied. A special clear top coat is used for outdoor applications.
Powdered Iron	**Durex**	Easily formed into complex parts without machining operations. Graphite content provides certain amount of self-lubrication. Has relatively high hardness and resistance to wear, as well as tensile and compressive strengths equivalent to cast and malleable irons.	Has found application in gears requiring accurately formed tooth profiles, guide blocks for machine saws, textile machine bearings where corrosion prevents the use of copper alloys, and cams.
Phenolic Casting Resin	**Durez 7421**	A resin that is readily cast at room temperatures through the use of an accelerator. It is a thermosetting material that can also be set by baking for two to four hours at 140 degrees F. It has a compressive strength of 15,000 to 20,000 pounds per square inch.	This phenolic casting resin has been developed for metal-forming dies, jigs, fixtures, etc.
Phenolic Molding Compound	**Durez 11540**	Phenolic molding compound with high impact strength and surface finish with a durable luster.	For general-purpose uses.
Phenolic Molding Compound	**Durez 11863**	Phenolic molding compound having very low power factor (0.07 at 1000 K. C.) and high dielectric breakdown and fatigue strength. Has excellent compression moldability.	Especially developed for radio parts, such as condensers, crystal-holders, etc.
Phenolic Molding Compound	**Durez 11934**	Macerated fabric-filled phenolic molding compound with good curing time.	Used for general purposes where relatively high impact strength is required.
Blackening Process	**Ebonol C**	Process that forms jet-black coating of cupric oxide, which will not chip or flake off. Coating can be buffed, and does not require lacquering to prevent wear. Can be heated to almost dull red heat without flaking.	Suitable for blackening copper, beryllium copper, bronze, phosphor bronze, and brasses with zinc content of 35 per cent or less.

Review of Some Recently Developed Materials— Continued

Class of Material	Trade Name	Properties	Applications
Steel	**Elastuf 44**	Unusually uniform cross-sectional hardness of about 44 Rockwell C. Tensile strength, 200,000 pounds per square inch; elongation in 2 inches, 13 per cent. A smooth high luster is readily obtained in turning, threading, milling, or gear-cutting operations. Not suitable for welding.	Suitable for gears, worms, pinions, bull riveter dies, injection molding machine parts, compression dies and blocks, shafts, especially those on which roller bearings run without an inner race, and high-speed shafts or axles subject to great torsional impact.
Metal Finish	**Electro-Jetal**	A black rustproof finish that provides an absorptive base for subsequent treatment with oil, wax, or lacquer.	Applicable to any metal surface that can be copper-plated.
Grinding Wheel Dressing Compound	**Ever-Drest**	A compound that is added to grinding-wheel water to reduce water surface tension and to keep the pores of the wheel open. Intended to prevent burning of the wheel surface.	This compound is suitable for use with organic or vitreous wheels and with hard or soft water. Designed to permit use of closer grained wheels for better finishes.
Penetrating Rust Solvent	**Exola**	A compound that combines chemically with rust or corroded metal to form a metal stearate similar to grease.	For freeing metal parts that have rusted or corroded together.
Rubber Strip Substitute	**Fel-Pro**	Synthetic strip material having the spongy characteristic of rubber strip. Is produced by applying Thiokol to specially processed felt base.	Has been used on Army vehicles for tail-gate moldings and is finding numerous industrial applications.
Brazing Flux	**Fluxined-Spelter**	A brazing flux that can be used in connection with furnace, torch, or spot-welding methods.	Suitable for joining carbide and all other types of cutting tips to tool shanks.
Aluminum Substitute	**Formula C-102**	Non-metallic material, one-third lighter than aluminum, made from fibrous and rubber-like ingredients. Resists ripping or shattering under gunfire, will not crystallize from vibration, and is free from corrosion and pin-hole formation.	Used in bullet-puncture sealing fuel tanks. Anticipated use to replace aluminum panels in bus and truck body construction.
Regalvanizing Process	**Gav-Weld**	A low-melting galvanizing material rubbed over bare spots at welded joints, to provide smooth wear-resistant and corrosion-resistant coating. Permits welded joint to be painted or enameled without danger of sweating.	Suitable for application in shipbuilding and contracting work; manufacture of tanks, cans, barrels, prefabricated steel houses, railroad cars, trucks, and other welded products.
Compound for Coating Glass	**Glasshield**	A transparent protective coating for glass, which does not interfere with vision or light transmission.	When applied to windows, it prevents shattering due to vibration from exploding bombs.
Tubing	**Gloweld**	An electrically welded stainless-steel tubing with high strength and corrosion resistance. Can be readily bent, coiled, swaged, and formed.	For hydraulic lines and structural and engine parts in aircraft construction.
Sweeping Compound	**Grease Ball**	A compound, containing no caustics or acids, for removing accumulations of grease and oil from floors.	In use, is sprinkled on deposit, scrubbed into grease or oil until deposit is soaked up, and then swept away.
Degreasing Agent	**Gunk X-11**	Available in the form of a concentrate that may be diluted with a grease solvent before using. Cleaning operation is carried out by cold immersion of greasy or dirty parts.	Suitable for use as a mineral grease and dirt-digestive solvent.

Review of Some Recently Developed Materials— Continued*

Class of Material	Trade Name	Properties	Applications
Tin-plating Process	**Halogen Tin Process**	Electrolytic process that is much faster than "alkaline" electro-tinning method. Sludging is eliminated. Tin deposited by this process can be heated without discoloration.	For plating strip steel. Useful in plating cans to save tin where thin coating is desired.
Zinc-plating Process	**Hubbell-Weisberg Process**	A method of electroplating steel products with zinc from relatively low-cost sources, such as galvanizers' skimmings, brass foundry fume, and organic reduction residues.	Process claimed to produce zinc-coated wire or strip equivalent to that produced by other plating methods. Commercially economical when 1½ to 2½ tons of zinc are utilized every twenty-four hours.
Polishing-Wheel Adhesive	**H-VW-M Adhesive**	An adhesive used in the same way as glue, being heated and applied while warm. Unused material can be reheated without waste.	Developed as a substitute for glue in facing coarse- and fine-grain polishing wheels.
Lining for Concrete Forms	**Hydron**	A light, flexible, and easily handled material that aids in producing smoother and harder concrete surfaces by removing water and air bubbles from them.	Used as a lining, consisting of absorptive material faced with a fabric, in concrete forms.
Steel Tubing	**Imperial Bundy**	A soft-temper steel-tubing, copper-coated inside and outside, with additional tin coating on outside. Said to be stronger than copper tubing and to have greater resistance to vibration fatigue.	Can be used as a substitute for copper tubing and is suitable for gasoline and oil lines; machine tool hydraulic and lubrication lines; conduit tubing; vacuum lines; refrigeration condensers; etc.
Weld-Spatter Protective Compound	**Industrial Finish Flash-Off No. 99**	A compound that prevents adherence of weld spatter to parts being welded together. Also removes impurities from the weld and prevents pitting on galvanized or ungalvanized surfaces.	In use, the compound is wiped, brushed, or sprayed along surfaces adjacent to edges to be welded together. Grinding or scratching operations to remove spatter are eliminated.
Metal Coating	**Irco Zinc Coat**	Provides a rust-inhibiting base of zinc-phosphate. Applied by dipping metal, after cleaning, in processing solution for five minutes to one hour.	Used as a base for paint, enamel, or lacquer finishes, or may be used as a final finish.
Protective Coating	**Koilkote**	A protective coating that reduces the frequency and length of time required to clean rustproofing system coils.	Intended especially for use on steel coils in rustproofing systems.
Labeling Material	**Kum-Kleen**	Material that adheres permanently and without moistening to any smooth surface, whether metal, glass, plastic, enamel, varnish, or wood.	Used as a substitute material for nameplates, metal tags, patent number plates, etc.
Plastic Insulation	**Lignin**	A plastic fiber made out of water waste from sulphite-paper manufacture. Produced in the form of paper sheets possessing good electrical characteristics. The material is less corrosive than phenol fiber. It can be easily punched.	Insulating material suitable as a substitute for phenol fiber.
Metal Cleaner	**Lixol**	A metal cleaner of low viscosity, which forms a milk-white emulsion with water and dilutes clear with kerosene.	Suitable for pressure spray washing or for dipping or slushing to remove oil and grease coatings, particularly those containing abrasives or other solid dirt.

*This review will be concluded in November MACHINERY

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 183 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the October Number of MACHINERY

Precision Thread Grinders

LANDIS MACHINE CO., Waynesboro, Pa. Folder descriptive of the Landis No. 6 precision thread grinder for work requiring extreme accuracy. Bulletin E-93, containing construction details on No. 6 precision thread grinders. 1

Operating Manuals for Pipe-Threading Machines

OSTER MFG. CO., 2073 E. 61st St., Cleveland, Ohio. Operating and maintenance manuals covering the Oster Nos. 422, 502, and 562 portable pipe-threading machines, and No. 300 series stationary pipe- and bolt-threading machines. 2

Welding Aluminum

OAKITE PRODUCTS, INC., 26 Thames St., New York, 6, N. Y. Treatise on the proper surface preparation for spot- and roll-welding of aluminum and aluminum alloys contained in the publication *Oakite News Service*. 3

Power Transmission Maintenance

CLING SURFACE CO., 1048 Niagara Street, Buffalo, N. Y. Booklet entitled "Is Industry's Power Transmission Program Geared to War Production Demands?" containing suggestions on maintenance of power transmission systems. 4

Gear-Shift Drives and Polishing Lathes

LIMA ELECTRIC MOTOR CO., Lima, Ohio. Catalogue covering electric motors, gear-shift drives for machine tools, pedestal grinders, magnetic polishing lathes, and special rotors and stators. 5

Super-Quench Oil

GULF OIL CORPORATION, 3800 Gulf Bldg., Pittsburgh, Pa. Booklet containing data on the properties of a new quenching oil known as "Super-Quench." Results of tests made on parts quenched with this new medium are included. 6

Test Data on Precision Saws

DOALL CO., 1215 Thacker St., Des Plaines, Ill. Catalogue on DoAll precision saws, containing the results of typical tests made by the research laboratory of the concern to solve unusual cutting problems for users. 7

Instructions for Operating Wilder Projector

GEORGE SCHERR CO., INC., 126 Lafayette St., New York, 13, N. Y. Leaflet containing complete instructions for setting up and operating the Wilder micro projector for optical checking of work. 8

Universal Slotting Attachment for Milling Machines

EXPERIMENTAL TOOL & DIE CO., SPECIAL MACHINERY DIVISION, 12605 Greiner Ave., Detroit, Mich. Bulletin E 843, illustrating and describing typical applications of the Universal Slotmaster. 9

Motor Maintenance Handbook

IDEAL COMMUTATOR DRESSER CO., Sycamore, Ill. Motor maintenance handbook (88 pages), telling how to keep motors and generators operating at peak efficiency. 10

Plastics Handbook

E. I. DU PONT DE NEMOURS & CO., INC., Plastics Department, Arlington, N. J. Handbook containing instructions for fabricating "Plastacele" cellulose acetate plastic sheets used in the aircraft and other industries. 11

Heavy-Duty Lathes

SOMMERFELD MACHINE CO., Box 286, Braddock, Pa. Bulletins 443-1, 443-2, and 443-3, describing the complete line of heavy- and medium-duty Sommerfeld lathes, which were formerly known as Pittsburgh lathes. 12

Blast Cleaning Equipment

AMERICAN FOUNDRY EQUIPMENT CO., 555 S. Byrkit St., Mishawaka, Ind. Catalogue 40 (revised edition), covering the entire line of blast cleaning equipment made by this company. 13

Thread Rolling Handbook

ROLLED THREAD DIE CO., Department M, Worcester, 2, Mass. Thread rolling handbook, containing technical information on the design and production of screws and other threaded parts. 14

Magnetic Pulley Maintenance Manual

DINGS MAGNETIC SEPARATOR CO., 509 E. Smith St., Milwaukee, 7, Wis. 40-page handbook on the operation and maintenance of magnetic pulleys. 15

Air Cylinders

TOMKINS-JOHNSON CO., Jackson, Mich. Catalogue (92 pages) on T-J air cylinders, containing data for determining the exact cylinder required for any job of pneumatic power movement. 16

Stainless-Steel Electrode Chart

ALLOY RODS CO., York, Pa. Chart containing a list of A.I.S.I. numbers for arc-welding electrodes for stainless steel and the comparable electrodes as made by fifteen different companies. 17

Pipe Gages

THREE-POINT GAGE CO., 3821 Broadway, Chicago, Ill. Folder illustrating and describing a three-point gage for measuring pipe from 1/8 inch to 12 inches. 18

Tool Engineering

A. W. HECKER, 1976 E. 66th St., Cleveland, Ohio. Booklet entitled, "Tooling for Speed and Accuracy," outlining the general engineering service offered by this firm. 19

Balancing Machines

TINIUS OLSEN TESTING MACHINE CO., 530 N. 12th St., Philadelphia, Pa. Bulletin 26, illustrating and describing Olsen Type E-O static-dynamic balancing machines. 20

Welding Machines

SCIAKY BROS., 4915 W. 67th St., Chicago, 38, Ill. Bulletin 101-B, on the Sciaky PMCO 2S-5 electric resistance welder for aluminum and its alloys. 21

Pneumatic Chisels

DALLETT CO., Mascher at Lippincott St., Philadelphia, Pa. Bulletin 200, giving sizes of pneumatic chisel blanks and chisels. 22

Spark-Testing

CARPENTER STEEL CO., 109 Bern St., Reading, Pa. "Spark-Testing Guide," a 21- by 30-inch wall chart, designed to assist in spark-testing tool steels. 23

Hydraulic Presses and Pumps

WATSON-STILLMAN CO., Roselle, N. J. Bulletin 350-A, on Watson-Stillman laboratory presses. Bulletin 250-A, on Stediflo hydraulic pressure pumps. 24

Heat-Treating Furnaces

DESPATCH OVEN CO., Minneapolis, Minn. Bulletin 83, covering performance, construction, and uses of Despatch heat-treating furnaces for tools, dies, etc. 25

Anti-Friction Bearings

AHLBERG BEARING CO., 3052 W. 47th St., Chicago, 32, Ill. 32-page book entitled "Facts About Anti-Friction Bearings," containing design and application data. 26

Machine Tools

GIEBEL MACHINE TOOL CO., 250 W. 57th St., New York City. Catalogue listing the standard and special machine tools handled by this company. 27

Oil Reclaiming Equipment

FLETCHER WORKS, Glenwood Ave. and Second St., Philadelphia, Pa. Circular on the Fletcher chip wringer for reclaiming oil from metal chips. 28

Electric Furnaces

GENERAL ELECTRIC CO., Schenectady, N. Y. 82-page catalogue (GEA-4049), covering the complete line of GE electric furnaces for precision heat-treatment. 29

Rolled Composite Die Sections

JESSOP STEEL CO., Washington, Pa. Folder containing dimensions and application data covering Jessop rolled composite die sections, available in eight sizes. 30

Colloidal Graphite

ACHESON COLLOIDS CORPORATION, Port Huron, Mich. Bulletin 431-YY, containing information on dag colloidal graphite for impregnation and surface coatings. 31

Coolant Filters

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio. Catalogue on Fostoria localized filtering equipment designed for use on grinding, polishing, broaching machines, etc. 32

Hydraulic Slotters

ROCKFORD MACHINE TOOL CO., Rockford, Ill. Circular illustrating and describing the new 12-inch "Hy-Draulic" slotter. 33

Chip-Breaker Grinder

CARBOLOY COMPANY, INC., Detroit, Mich. Technical bulletin GT-158, containing data on chip-breaker grinders. 34

To Obtain Copies of New Trade Literature

listed on pages 182-184 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name ..... *Position or Title* .....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

Gearmotors

GENERAL ELECTRIC Co., Schenectady, N. Y. Bulletin GEA-1437D, on gearmotors with from 1/8 to 75 H.P. ratings. 35

Steel Hardening Solution

STEELTEM CHEMICAL Co., 51 E. 42nd St., New York City. Folder describing a new steel hardening solution called "Steel-Temp." 36

* * *

Foremanship Training Film

A motion picture film that deserves high praise has been brought out under the auspices of the Pratt & Whitney Aircraft Division of the United Aircraft Corporation, East Hartford, Conn. The subject of this film is foremanship training. One of the points on which special emphasis is laid is the fact that the foreman is part of the management.

Briefly, the film covers the following topics: The importance of handling people in manufacturing plants; the importance of the foreman's knowing each individual in his department; the importance of properly introducing the new worker in order to win his respect and confidence; the importance of checking medical restrictions before assigning work to employes; right and wrong way to handle requests for raises; upgrading and training of employes; fitting the man to the job, job analysis, etc.; the foreman's relations to the time-study department, the production engineers, the stock chasers, and the plant protection system. An interesting part of the film is devoted to intershift cooperation between foremen.

While this motion picture was prepared specifically for use in the Pratt & Whitney aircraft plants, arrangements are now being made with a national distributor to handle the film for a small booking and handling charge. For the present, inquiries relating to the foremanship training film, which is entitled "It's Our Job," should be addressed to H. C. O'Sullivan, director of training, United Aircraft Corporation, East Hartford, Conn. The picture is available as a 16-millimeter sound projection film.

Lincoln Employes Approach the Government on Renegotiation

The Navy Department is renegotiating contracts with the Lincoln Electric Co., Cleveland, Ohio. In connection with the renegotiation proceedings, the Advisory Board of the Lincoln Electric Co., representing the employes, sent the following telegram to the Navy Department Price Adjustment Board:

"We, the members of the Advisory Board of the Lincoln Electric Co., representing 1400 employes, have been advised today for the first time that your Board is renegotiating the Lincoln Electric Co. for 1942. Since many of the workers are stockholders and all share in the profits, this matter is of vital importance to all of us. Hence, we want your answer to the following questions:

"1. We are producing at more than four times the rate per man-hour of any of our competitors, as you know from your investigation. How much must we reduce this efficiency and raise costs to keep from being penalized in renegotiation? Please be specific. Should it be reduced 1/4, 1/2, 3/4 or more?

"2. Have you squared your policy with WPB and the Treasury? WPB asks for more efficiency. The Treasury asks for more taxes. The penalty you set up will tremendously reduce both.

"3. This penalty for efficiency was not made public in the renegotiation law as passed by Congress. Why? No such penalty for efficiency is apparent in our reading of the law.

"We are requesting our chairman, Mr. Lincoln, to follow the matter, so that this penalty on efficiency may be stopped."

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 185-214 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in October, 1943, MACHINERY.

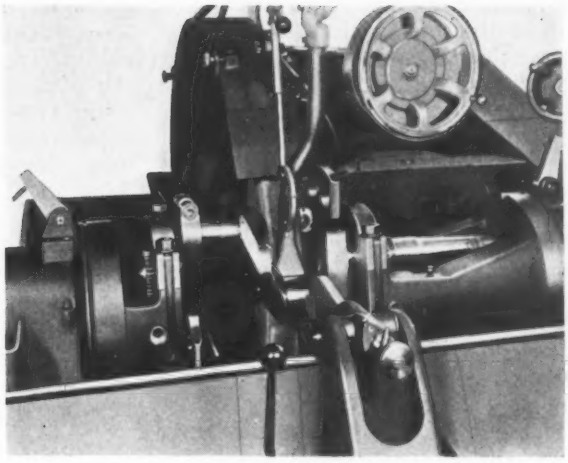
No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, 13, N. Y.

[SEE OTHER SIDE]

Shop Equipment News



Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

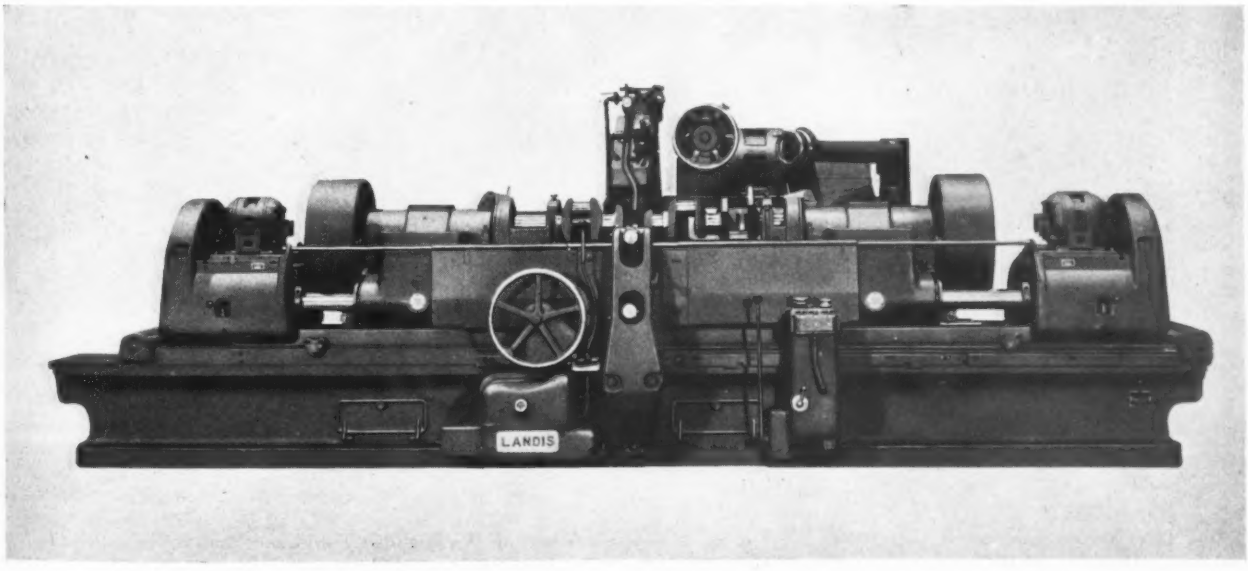
Landis Hydraulic Crankpin Grinders

Recent demands for greater accuracy combined with higher output in the production of crankshafts led to the development of a new 25-inch Type DD hydraulic crankpin grinder by the Landis Tool Co., Waynesboro, Pa. This new machine, in the shorter bed length, is recommended for crankshafts of single- and double-throw air-cooled radial engines and of in-line liquid-cooled engines. Crankshafts for many of the smaller Diesel engines can also be handled on the longer bed machines.

An outstanding feature of this grinder is the dual work-drive, which eliminates or minimizes axial deflection in the crankshaft. The speed of the two work-driving motors is synchronized electrically. Both work-heads can be moved transversely on the top of the work-table by means of rack and pinion arrangements. Shafts that vary in length can, therefore, be handled on the same machine. The work-spindle bearings are automatically flood-lubricated, convenient gages being provided for checking the oil supply.

The work-heads are adapted for handling shafts of considerable weight. A unique method of correcting any out-of-balance condition in the crankshaft consists of employing two balancing weights mounted on a circular plate attached to the outer end of each work-spindle. Latches are provided for holding the two work-fixtures in accurate alignment during loading and unloading.

A rugged shoulder-grinding attachment is supplied to enable the crankshaft cheeks to be rapidly and efficiently ground. Control of this attachment is by means of a handwheel located close to the up-feed handwheel of the machine. Graduations in tenths of an inch



Landis Hydraulic Crankpin Grinder with Dual Work-drive

To obtain additional information on equipment described on this page, see lower part of page 184.

enable the operator to accurately gage the amount of sidewise feed in either direction within a travel range of 5/8 inch. Smoothness of operation is assured by the worm and worm-wheel design and by the use of an anti-friction type of thrust bearing. This attachment is not intended merely for slight truing up of the cheeks, but for the rapid removal of as much metal as required.

The crankshafts are rigidly supported by a rugged stationary work-rest mounted on the bed. A quick-acting lever permits the operator to bring both shoes instantly into the operative position and also drop them to the inoperative position. With the shoes in the inoperative position, the work-table can be traversed without danger of interference between the crankshaft flanges and the shoes. Hand adjusting screws are provided for final positioning of each shoe.

The hydraulic straight in-feeding mechanism is of the same basic Landis design used in connection with other equipment developed by this company. Because of the large flanges inherent in the design of many airplane engine crankshafts, it is necessary that provision be made for bringing the wheel back a considerable distance to avoid the possibility of interference while the work is being traversed. The amount of rapid feed movement on these machines is 12 inches. A grouping of three controls at the front of the machine permits the operator to readily control the direction of the feed and adjust the speed of both the fast and slow feeding movements. Landis Microsphere wheel-spindle bearings are used for the 48-inch diameter grinding wheel, which is considered standard.

The Type DD machine is available in 25- by 48-inch, 25- by 80-inch, 25- by 96-inch, and 25- by 120-inch sizes. Each of the work-driving motors is of 1 H.P., while the wheel-driving motor is 25 H.P. The weight of 33,860 pounds for the 25- by 48-inch size indicates the massiveness of these new grinding machines. ——— 51

Fellows Fine-Pitch Gear-Shaving Machine

The Fellows Gear Shaper Co., Springfield, Vt., has placed on the market a new gear-shaving machine designated the No. 4, which is adapted particularly for shaving small fine-pitch external spur and helical gears. This machine will handle gears up to 4 inches pitch diameter, 1 inch face wid h, and 20 diametral pitch, and finer. The work is held on fixed centers located in an adjustable headstock and tailstock, experience having shown that fixed centers are preferable to live centers for small-diameter fine-pitch gears, because this method of holding the work insures greater accuracy with respect to concentricity.

The machine is so designed that the work-slide, instead of the shaving tool, is reciprocated. The reciprocating movement is imparted to the work-slide by a unique type of crank mechanism which moves the work slowly across the shaving tool. The work-table is adjustable on this slide, so that it can be set for correcting taper.

The head that carries the shaving tool is adjustable for cross-axes setting, and has a maximum angular movement of 20 degrees both sides of the center position.

Fig. 1. Fellows Fine-pitch Gear-shaving Machine with Guard Lowered to Show Tool, Work, and Slide

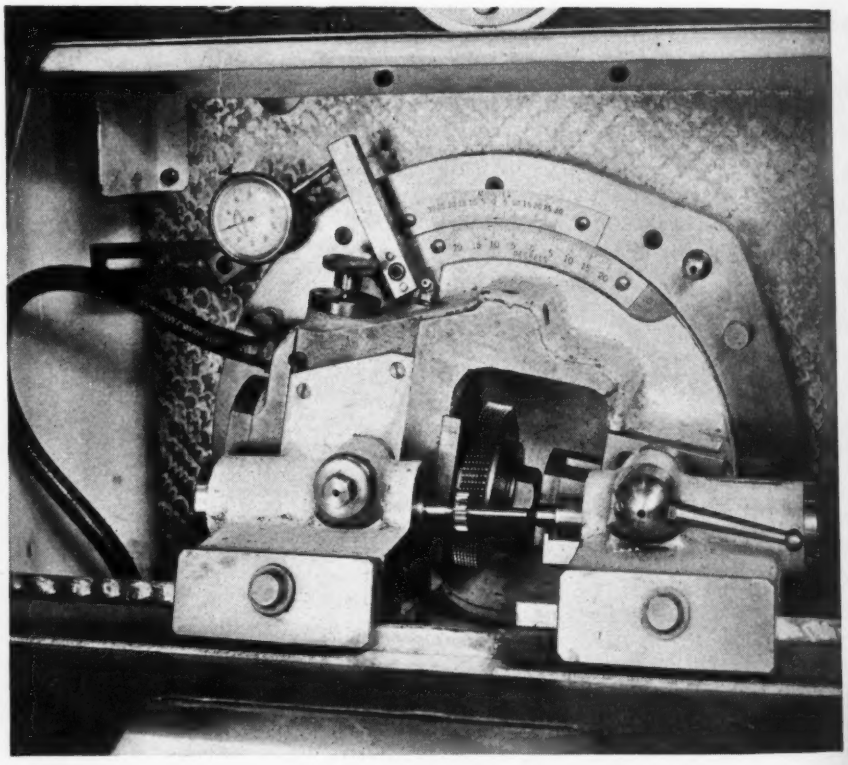
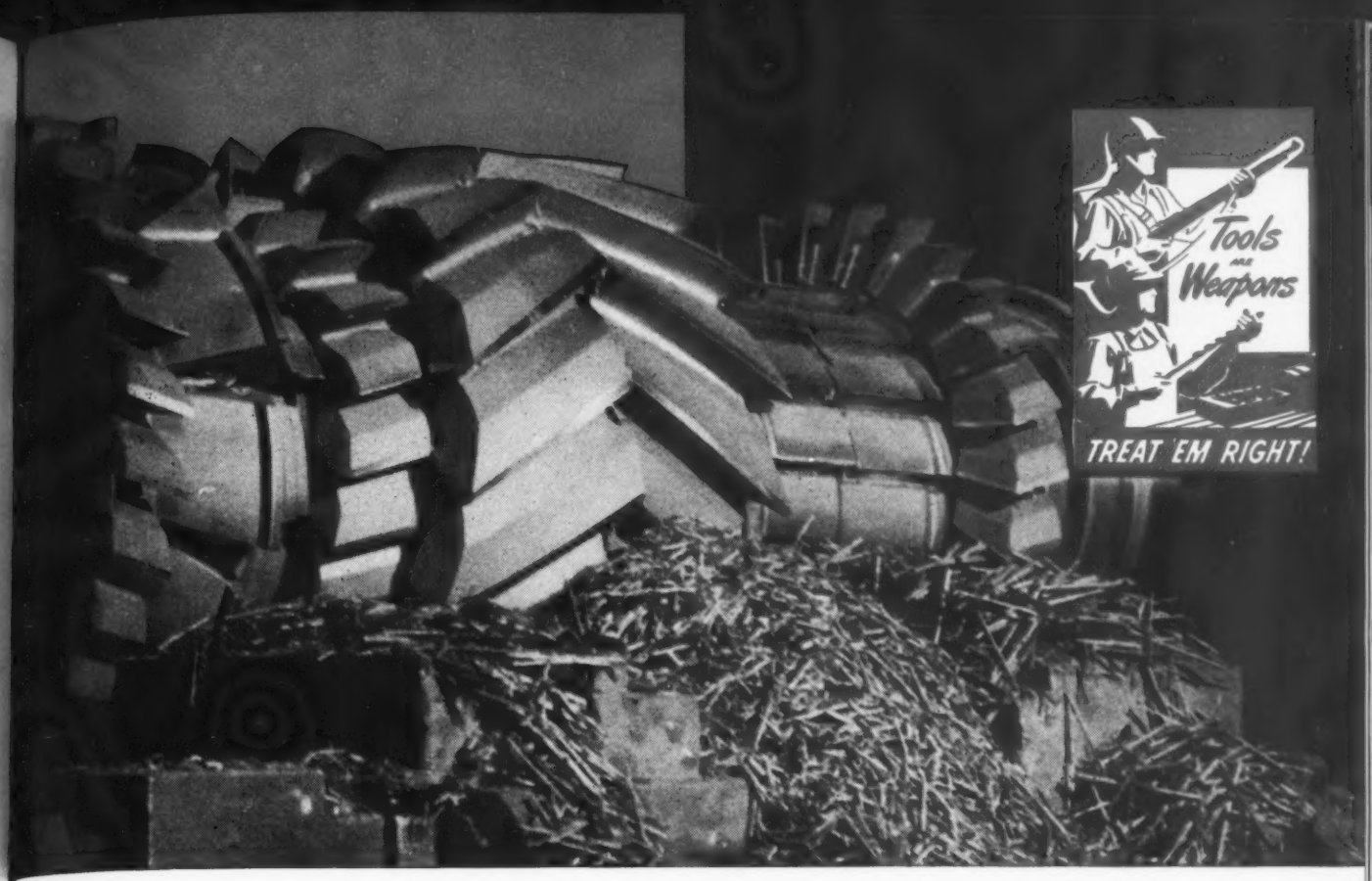


Fig. 2. Close-up View of Work-slide, Tool-head, and Vernier Scales for Crossed-axes Angle Setting of Fellows Gear-shaving Machine Illustrated in Fig. 1

To obtain additional information on equipment described on this page, see lower part of page 184.



Cutters Give You More Production When You Give Them More Care

Follow These Simple Suggestions • They Will Help You Increase Your Production

HANDLE CUTTERS carefully to prevent damage to the cutting edges.

HAVE THE WORK CLAMPED AND SUPPORTED PROPERLY. Work not held rigidly can cause premature cutter wear or even breakage.

MOUNT CUTTERS as closely as practicable to the spindle.

USE ARBORS OF SUFFICIENT DIAMETERS. Insert arbor shanks carefully in thoroughly cleaned taper holes. Ends of collars should not be bruised. Provide adequate arbor support.

RUN SMALL CUTTERS (such as end mills) at the same surface speed as that used for larger cutters.

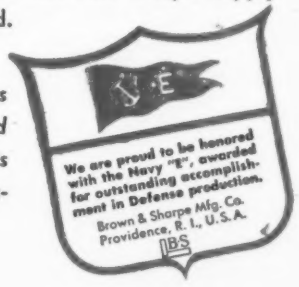
KEEP CUTTERS SHARP. When cutters are used after they have become dull excessive metal is lost in sharpening. On a production job, sharpen cutters after a predetermined number of cuts regardless of wear.

IN SHARPENING, control cutter clearance carefully and remember softer metals may require several times the clearance of cutters for iron and steel.

COUNTERACT CHATTER. Incorrect clearance and lack of rigidity of machine or cutter drive contribute to chatter which can cause abnormal cutter wear.

BE SURE MACHINE IS HEAVY ENOUGH to stand the cut and use the correct spindle speeds with each setup. Supply ample coolant where it is required.

Give cutters extra care these days when the supply available is limited so that the production requirements for our armed forces can be maintained.


We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BS

BROWN & SHARPE CUTTERS

A scale for indicating the degrees of angle and a vernier for indicating the minutes of angle are provided for setting the tool-head to the required angle, as shown in Fig. 2. A dial indicator can be used for finer settings.

Complete electrical push-button control is provided, both for operating the tool and reciprocating the slide. Accurate means for setting the tool relative to the work, including a dial graduated to 0.0005 inch, are available. Once the machine is set, of course, the proper depth is maintained by means of a depth feed cam.

The tool-spindle is driven by a separate motor mounted in the feed-slide. The motor that drives the work-slide also operates the compound pump, and is provided with a "plugging" switch to prevent "coasting" of the slide. The machine is automatically lubricated by a Bijur lubricating pump. 52

Cincinnati Improved "Hypro" Frog and Switch Planer

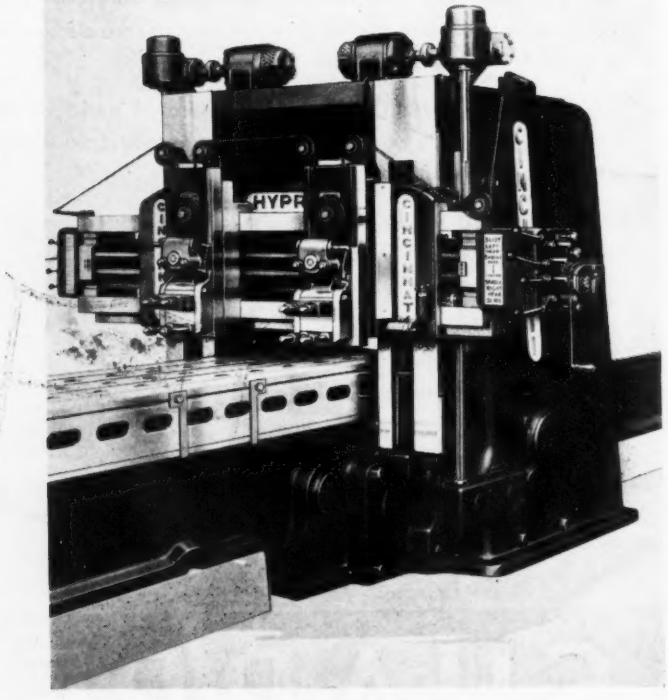
The Cincinnati Planer Co., Cincinnati, Ohio, has brought out an improved type of "Hypro" frog and switch planer. This planer has a double-length, enclosed type bed and a full length, box-section arch designed to increase the rigidity of the housings. Other improvements include a wider V-spread for the bed and a table of greater depth provided with full-length hold-down gibs. The new design was developed by the company's engineers in cooperation with frog, switch, and crossing manufacturers, and is designed for speed and accuracy, as well as for convenience and safety of operation.

The combination herringbone balanced drive is designed for efficient, smooth operation under the heaviest cuts, and is able to carry a load of 100 H.P. All shafts are of large diameter and have hardened, ground, and lapped journals. Heavy-walled bronze bushings are used throughout the drive train. Tool-blocks, clapper-boxes, and clamps are of steel. The tool-blocks are designed with an abutment that relieves the strain from the clapper-box pin. A self-locking worm is provided for swiveling the clapper-boxes.

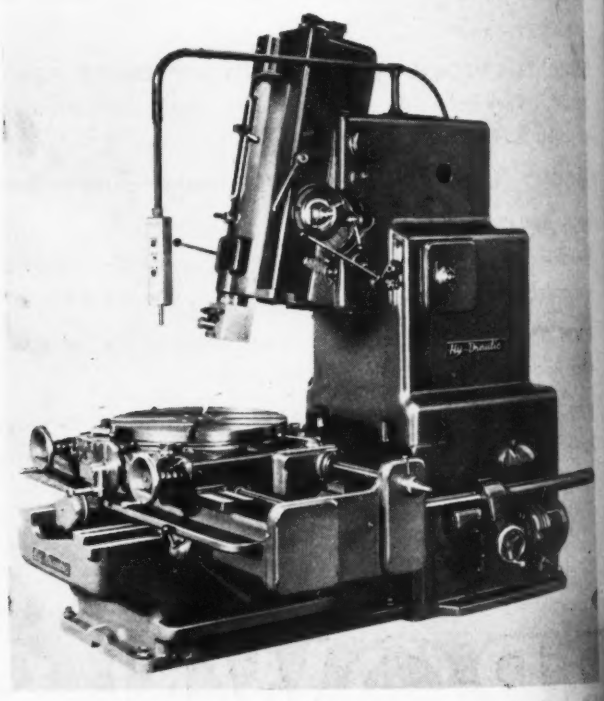
The feed and traverse sealed unit has hardened gears and clutches, with all shafts mounted in anti-friction bearings that run in a bath of oil. This arrangement provides a high degree of flexibility in the directional controlled traverse and feed. Heads and slides can be fed and traversed in any direction independently or together. There is a special jogging device for feeding the tool into the work for tapering and trimming as the table moves in the direction of the cut. The planer heads can be moved manually either in the same direction or in opposite directions simultaneously by operating a single crank. 53

Rockford "Hy-Draulic" Slotter

A 12-inch slotter with a hydraulically driven ram and hydraulic feeds has been added to the "Hy-Draulic" line of machine tools built by the Rockford Machine Tool Co., 2498 Kishwaukee St., Rockford, Ill. This slotter is a heavy, powerful machine designed for precise, rapid slotting operations. The base, column, ram, table, and related parts are carefully machined to assure accurate alignment, and provision is made for making adjustments to take up wear.



"Hypro" Frog and Switch Planer Built by the Cincinnati Planer Co.



"Hy-Draulic" Slotter Brought out by the Rockford Machine Tool Co.

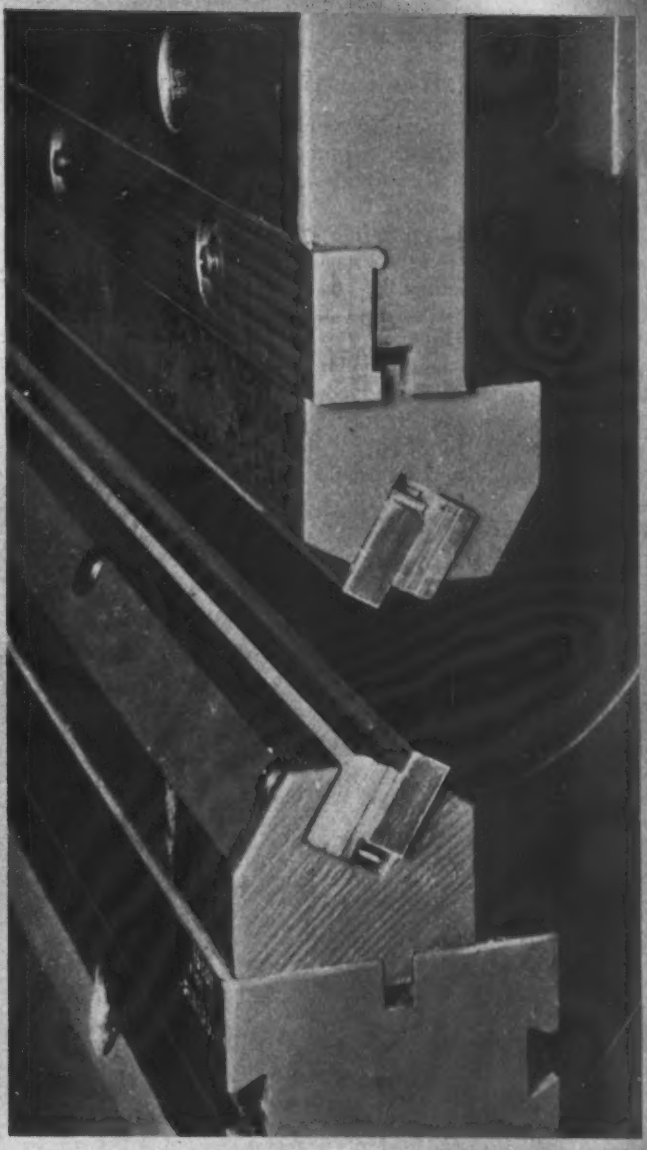
To obtain additional information on equipment described on this page, see lower part of page 194.

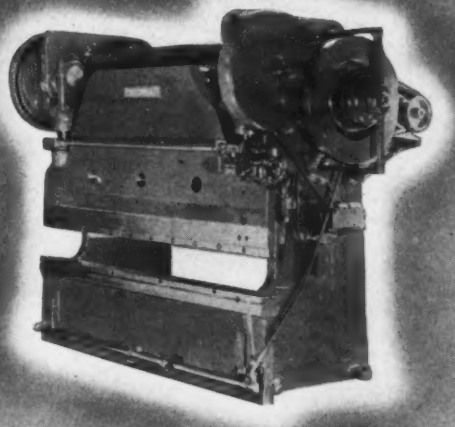
OFFSET BENDS...

Offset dies in one hit form offset bends that normally require two hits. These dies are usually single purpose. However, the Cincinnati Adjustable Offset Die, with a range of one hit offset bends, is very useful on occasion.

Cincinnati Press Brakes have the power and stamina necessary in developing the heavy pressures required for accurate, sharp offset bends.

Write for Catalog B-1





THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

The slotting ram has a maximum stroke of 12 inches and a minimum stroke of 1 inch. The cutting speeds are infinitely variable from 10 to 75 feet per minute, and the maximum ram return speed is 100 feet per minute. The ram housing can be tilted to an angle of 10 degrees from the vertical for angular or taper slotting. Graduations on a tapered ring facilitate setting the ram to the required angle.

The circular table is 28 inches in diameter, graduated on the periphery, and provided with T-slots. It has both manual and hydraulic feeds and power rapid traverse. Micrometer dials graduated to 0.001 inch are provided for longitudinal and transverse feeds.

The hydraulic feed to the table is infinitely adjustable between 0 and 0.106 inch per cutting stroke for transverse movement, between 0 and 0.053 inch for longitudinal movement, and between 0 and 0.106 inch on a circle 6 inches in diameter for circular movement. The table travel, both longitudinal and transverse, is 26 inches.

The table to ram dimensions range from 1/4 inch to 30 inches. The distance from the table to the bottom of the ram guide is 18 inches. The slotter has a capacity for working to the center of a circle 48 inches in diameter. The machine weighs 12,500 pounds, and requires a floor space of 86 by 112 inches. ---------- 54

Sheffield Ball Checking Machine

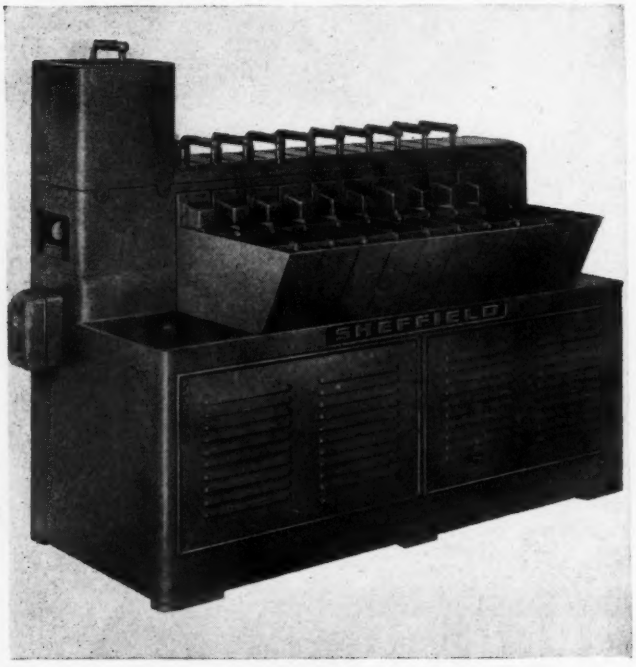
A new type of machine for the precision checking of the diameters of balls used in ball bearings at a much faster rate and with greater accuracy than is possible with methods formerly used has been developed, patented, and built by the Sheffield Corporation, Dayton, Ohio, for one of the largest manufacturers of ball bearings in this country. The machine checks and sorts balls ranging from 1/8 to 11/16 inch in diameter. One of these new machines is now checking balls at the rate of 15,000 to 20,000 an hour.

The balls to be checked are placed in the machine hopper from which a walking beam lifts them and carries them a few inches to an opening having accurate parallel sides. If the balls are of the same size as the opening or smaller, they fall through and are retained in a compartment below. This eliminates all under-sized balls. The remaining balls stay on top of the opening and are carried by the walking beam to the next stage, which has a slightly larger opening. This process is repeated until all the balls drop into one of the divisions or are too large to pass inspection and fall into the last compartment.

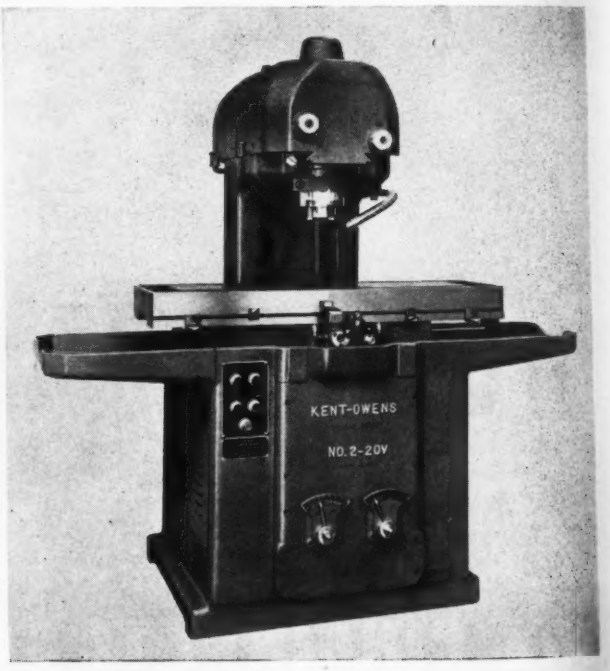
The machine can be set to segregate balls into ten classifications as follows: First under-size balls; then eight sizes, each of which is 0.00005 inch larger than the preceding size; and finally over-size balls. Master blocks having Carboloy inserts are used for the parallel sides of the steps that vary in increments of 0.00005 inch. Dimensions of the inspection steps can be regulated by changing the size of the opening between the parallel sides. ---------- 55

Kent-Owens Vertical Miller

A new model 2-20V vertical milling machine has been announced to the trade by the Kent-Owens Machine Co., Toledo, Ohio. This ruggedly constructed machine has a deep-section table which travels in ways directly in the bed. The table is 42 inches long by 12 inches wide, and has a 20-inch travel with a fully automatic operating cycle. It can be fed or rapid-traversed in either direction, automatically shifted from rapid traverse to the feeding speed in either direction, reversed at both ends of the stroke, and automatically stopped at any



Sheffield Ball Checking and Sorting Machine

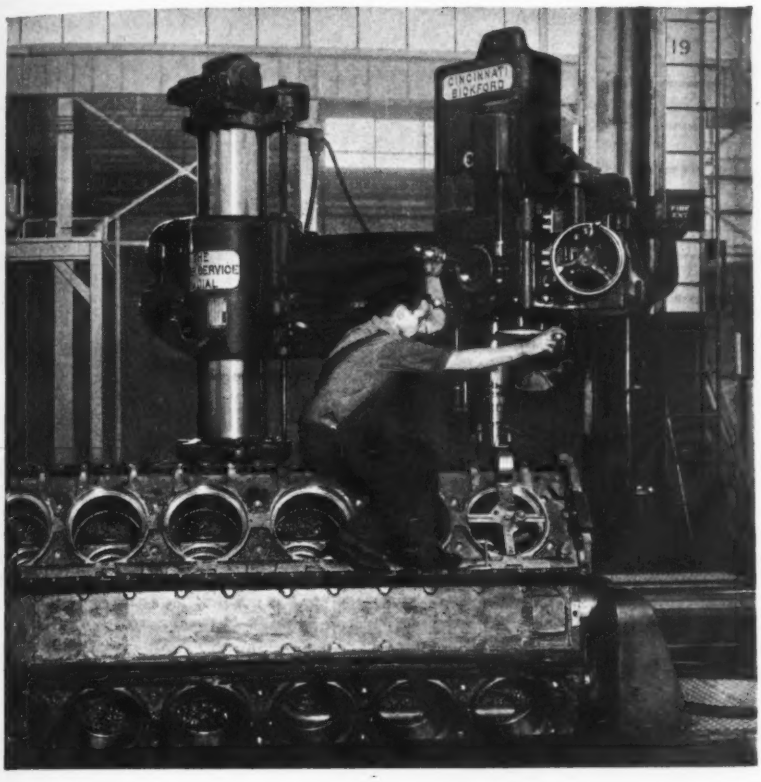


Vertical Miller Brought out by Kent-Owens Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 184.

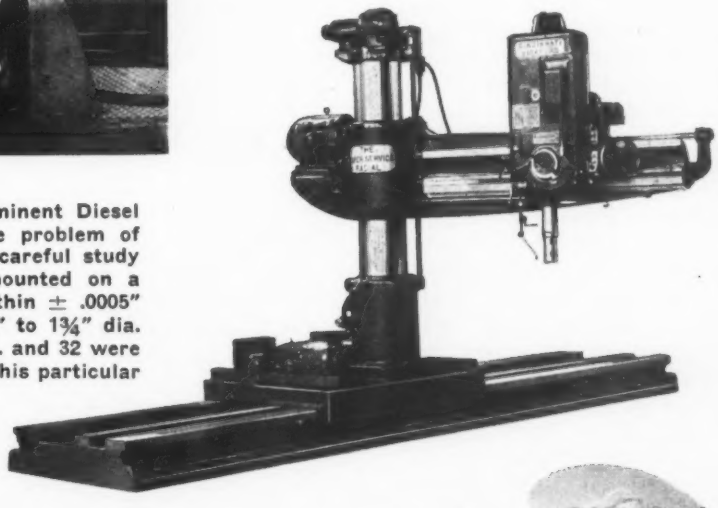
BUILDING DIESELS *FASTER*

for the RAILROAD *to* VICTORY

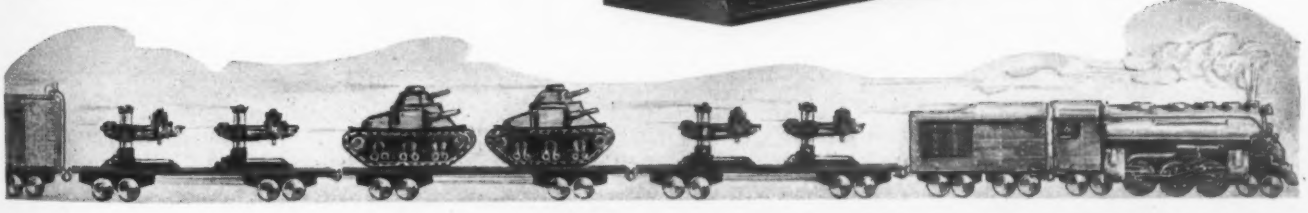


SUPER SERVICE C B

BELOW: Super Service Radial Drill equipped with sliding base and bed allowing 15' traverse. Bed ways are automatically oiled by forced feed lubrication. Power traverse and electric clamping of the sliding base are push-button controlled at the head where all controls are conveniently grouped.



ABOVE: This machine is in continuous use by a prominent Diesel Engine manufacturer. They were confronted with the problem of drilling operations in their 5600 lb. crank cases. After careful study they chose the SUPER SERVICE RADIAL DRILL, mounted on a sliding base, to facilitate over 1200 operations, some within ± .0005" center-line to center-line . . . 611 holes ranging from ¼" to 1¾" dia. were drilled . . . 487 were tapped . . . 72 were reamed . . . and 32 were counterbored . . . with a floor-to-floor time of 24 hours. This particular type of machine was selected due to its extreme versatility of not only its head, arm and column, but also its base construction.



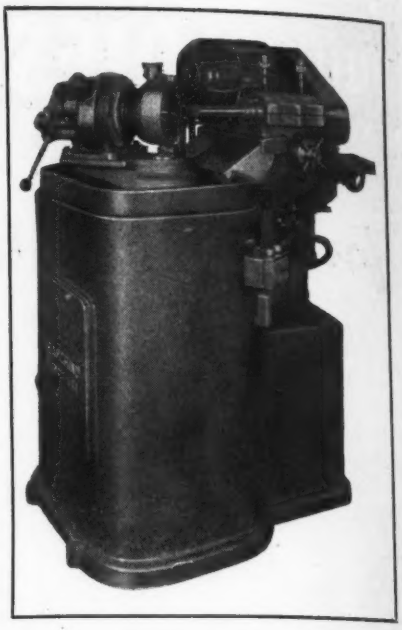
THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

desired point in its travel. Each direction of table travel has a separate feed-rate control dial, which is adjusted independently of the other. This makes possible efficient handling of entirely different operations at opposite ends of the table.

Three different column heights are available, permitting the minimum gap distance from table surface to spindle nose to be used for each job, in order to obtain maximum rigidity. With this arrangement, maximum gaps of 10, 12, and 14 inches are available, each of which has a 4-inch vertical quill adjustment.

Pick-off gears under a light aluminum cover on the head provide a wide range of spindle speeds. These gears run in an oil bath, and are easily removed for changing speeds. Gears covering a medium range of spindle speeds of from 64 to 860 R.P.M. are furnished as standard equipment, but gears for a low range of speed of from 32 to 428 R.P.M. or a high range of from 96 to 1248 R.P.M. can be provided. 56



Special Machine for Ball-groove Grinding Operation

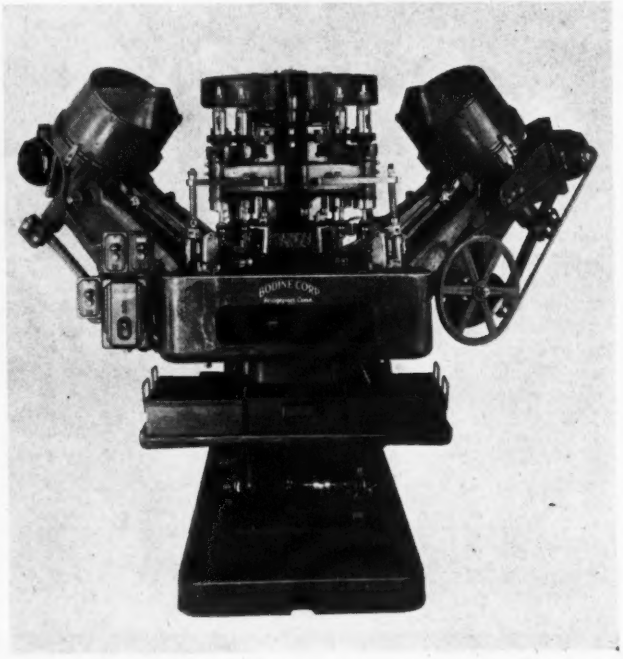
Bodine High-Speed Automatic Nut-Tapping Machine

The Bodine Corporation, 317 Mountain Grove St., Bridgeport, Conn., has developed a fully automatic nut-tapping machine which delivers four nut blanks simultaneously to four tapping stations by means of two hopper feeding mechanisms, each equipped with two adjustable chutes. Thus four nuts are tapped per stroke, the nuts from each spindle being discharged into a separate box, so that the product of each tapping spindle can be gaged individually prior to its delivery to the stock-room.

If desired, two sizes of nuts can be handled simultaneously. Each spindle carries a compensator which allows the tap to follow its own lead. The positive gear drives to the spindles are designed to eliminate distortion or tearing of threads in the tapped holes.

Two sizes of standard machines are available, one handling nuts up to and including 1/4–28, and the other 1/2–20. Both machines can be adapted for countersinking and tapping or drilling, counterboring, and tapping by the addition of a suitable automatic indexing dial. Thus a multiplicity of operations can be performed on a single blank.

Production depends upon the size of the nut and the material from which it is made. A 10–32 nut, for instance, of X1335 steel can be tapped at the rate of 160 per minute on the smaller size machine. When the work is of such a nature that it can be fed from a hopper, one operator can tend a battery of machines. The machines are motor-driven, and completely self-contained. 57



Bodine Double Hopper Four-station Nut-tapping Machine

Formed-Wheel Ball-Groove Grinder

The Gear Grinding Machine Co., 3901 Christopher, Detroit, Mich., has built a special "Geargrind" machine designed for grinding the ball grooves in the outer housing of Rzeppa constant-velocity universal joints made by this company. The work oscillates on a swinging head, controlled by an automatic magnetic brake, permitting the formed wheel to grind the ball groove to the required radii. The formed grinding wheel is fed in from the front, the rapid traverse of the table being governed by means of an air cylinder.

The spacing of the grooves is controlled by an accurate indexing head. This machine has a capacity for grinding the ball grooves in all the various sizes of Rzeppa universal joints, which range from 11/16 inch to 1 13/16 inches. 58

Grinding and Lapping Compound

The Quaker Chemical Products Corporation, Conshohocken, Pa., has brought out a new grinding and lapping compound known as "Microgrind No. 132." This is a dark, heavy-bodied liquid that, when mixed with water in proportions ranging from one part to three parts up to one part to seventy-five parts, makes a translucent, permanent solution. It is stable in hard or soft water, and can be used on all grinding, honing, lapping, or superfinishing opera-

To obtain additional information on equipment described on this page, see lower part of page 184.

WHEN IT COMES TO *Grinding* WITH ACCURACY

. . consider Ex-Cell-O precision equipment

Grinding on today's high and steady production basis places a heavy demand on the grinding spindle. It must be one that assures minimum end and radial play, as well as one that develops and maintains all the speed that's required for the job in hand, and accomplishes this for long periods of time without bearing adjustment or replacement. These are the exact features that have made the Ex-Cell-O spindle one of outstanding preference among machine tool builders. The greater accuracy, increased production, and better finish that a large number of industrial firms are obtaining today on machine tools equipped with the Ex-Cell-O Precision Spindle can, to a great extent, be attributed directly to the superior features of the Ex-Cell-O spindle ball bearing. These features include special methods developed and patented by Ex-Cell-O for precision fitting of the ball bearings.

Today's grinding practice brings Ex-Cell-O designed equipment right to the front. Ex-Cell-O precision-made products now entering far into the grinding field have made possible worthwhile improvements in methods to attain mass production with accuracy. There is the Ex-Cell-O thread grinder, introducing commercially a new precision process to American industry; the Ex-Cell-O tool grinder, bringing new efficiency in the grinding of cutting tools of carbide, stellite, and high speed steel; the Ex-Cell-O lapping machines for properly preparing female centers for grinding, and for the rapid precision finishing of small holes; and there is the Ex-Cell-O grinding spindle, widely used by the builders of internal, surface and universal grinding machines, for both original equipment and replacement. In the manufacture of all these products, only one standard exists at Ex-Cell-O—the best that highly trained engineers and skilled workers can produce. *If you have a grinding problem consider the equipment illustrated on these pages—the Ex-Cell-O name on each machine is positive assurance of it being a precision-built product to do a real precision job.*

PRECISION LAPPING MACHINES—(Above) Ex-Cell-O Style 74 for Center Lapping. With smooth, correctly shaped centers on workpieces, readily obtained through the use of this machine, greater precision can be assured when using grinding equipment. *To right:* Ex-Cell-O Style 71 Internal Lapping machine for lower cost precision finishing of plain straight holes and holes with interrupted openings.

EX-CELL-O CORPORATION • DETROIT

PRECISION THREAD GRINDERS—Ex-Cell-O makes nine styles of precision thread grinding machines, making it possible for each manufacturer of hardened threaded parts to select the exact type of machine required to handle his precision threaded work successfully on a profitable production basis.

CARBIDE TOOL GRINDERS—(*To left*) One of six styles of Ex-Cell-O precision-built tool grinders designed to refinish carbide-tipped and cutting tools of other materials. The machine illustrated is Style 44.

XLO

EX-CELL-O *for* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

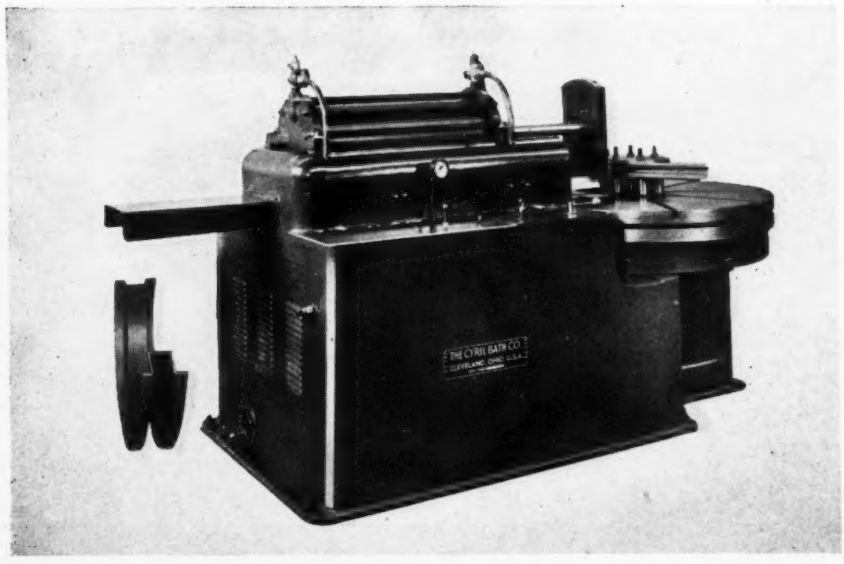
tions. This compound is said to completely eliminate glazing and loading of abrasives and to prevent recirculation of chips. It is non-injurious to skin and to metal, and is odorless and non-foaming. 59

Contouring Machine for Producing Irregularly Curved Members

The function of the contouring machine recently developed by the Cyril Bath Co., E. 70th and Machinery Ave., Cleveland, 8, Ohio, is to produce irregularly curved, shaped members from straight sections or flat stock. The shapes may be either constant or varied in cross-section, and flat stock can be formed to the same shape as an aluminum extruded section or the varied sections produced on presses. The curves produced may be simple or compound, and in one or more planes. Material that varies 200 or 300 per cent in tensile strength can be handled successfully. A typical hat-shaped section formed to a curved shape is shown at the left of the machine in the illustration.

The contouring machine has a round, variable-speed, power-driven table, and a hydraulic cylinder that operates in conjunction with the table. On the table is fastened a block of cast-iron Kirksite, Formite or other material approximating the shape to be formed. The flat material is ironed or stretched into shape by the pressure cylinder.

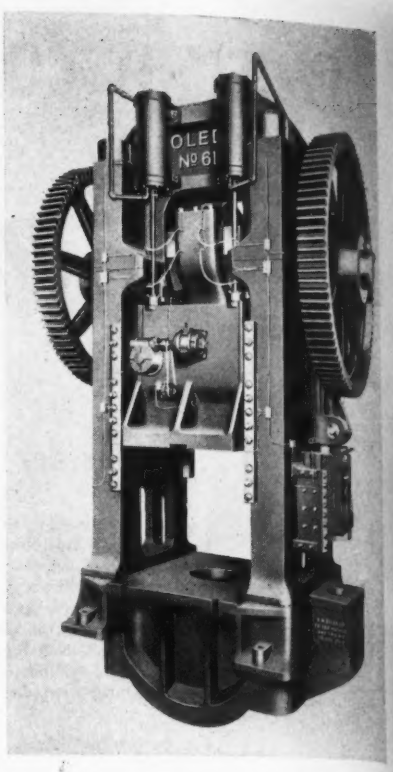
The machine can be applied for forming heavier materials, where the severity of the contour forces the material to flow beyond its elastic limit, and for forming lighter material where the contours are not severe. In the latter case, the material is stretched between a point on the table and the pressure cylinder, and then rolled to shape on the table. This is called "stretch contouring," and some modifications in the conventional model cylinder table relationship have been necessary to make it practical. By this means, very large shapes can be formed on rotary table machines simply by allowing the work to overhang the machine. 60



Contouring Machine Developed by the Cyril Bath Co., for Producing Irregularly Curved, Shaped Members from Straight Sections or Flat Stock

Bliss Mechanical Trimming and Reducing Presses

The 2000-ton mechanical trimming press shown in the accompanying illustration is believed to be the largest of its kind in the world. It was built recently at the Toledo Division of the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, 32, N. Y. This newly developed press is capable of trimming the average run of forgings as they come from a hammer of about 33,000 pounds capacity.



Bliss 2000-ton Mechanical Trimming Press

The machine is triple-geared, and operates at a speed of five strokes per minute, with a twin drive to the crankshaft. The construction is of the four-piece tie-rod frame type. The Bliss multiple-disk, flywheel type, air friction clutch and brake with electric push-button control is another feature of this machine. The air-counterbalanced slide has a stroke of 24 inches. The shut height from the top of the bed to the slide, with the stroke down and the adjustment up, is 42 inches. The slide is 87 inches by 60 inches, and the bed 98 inches by 72 inches. This machine weighs 450,000 pounds.

Another recent development of this company's is the application of the Bliss patented "quick-return drive" to a modern long-stroke mechanical reducing press. A uniform constant drawing speed and a quick return speed are the outstanding advantages of this modification of the conventional crank motion. As adapted to the No. 88-A single-crank, single-action press, for example, it permits operation at a materially increased rate, in strokes per minute, without any increase in the drawing speed. The quick-return principle as a time-saver resembles the action of metal-cutting shapers and planers.

To obtain additional information on equipment described on this page, see lower part of page 184.

For Every Job of *Steel Cutting* There's a Grade for *Top Performance*

● Whether your steel cutting job involves heavy hogging cuts such as ploughing through inch-deep cuts in cast armor plate, or light, high-speed work such as when precision finishing—or just average types of machining—you'll find there is a grade of Carboloy Cemented Carbide in each case best suited to give you top performance on steel.

Here are the four Carboloy Cemented Carbide Grades now widely used for steel cutting:

GRADE 78-B—A tough, wear resistant grade for *general purpose use* on practically all types of steel.

GRADE 78-C—A shock-resistant grade for machining steel parts on large, heavy duty machines, such as 9'-12' boring mills, 36"-48" lathes, etc. Excellent for interrupted cutting.

GRADE 78—A grade having high resistance to abrasive wear. For finishing and light roughing of practically all steels.

GRADE 831—A grade specially designed for long life on high speed precision finishing.

When you want maximum results at low tool cost per piece—specify CARBOLOY Cemented Carbide steel cutting grades. Send for catalog GT-142.

CARBOLOY COMPANY, INC., DETROIT 32, MICHIGAN

Birmingham · Chicago · Cleveland · Los Angeles · Newark · Philadelphia · Pittsburgh · Seattle · Thomaston, Conn.

CANADIAN REPRESENTATIVE: Canadian General Electric Co., Ltd., Toronto, Ont.
FOREIGN REPRESENTATIVE: International General Electric Co., Schenectady, N. Y.

For Cutting CAST IRON

CARBOLOY

(TRADEMARK) CEMENTED CARBIDES

For Cutting STEEL

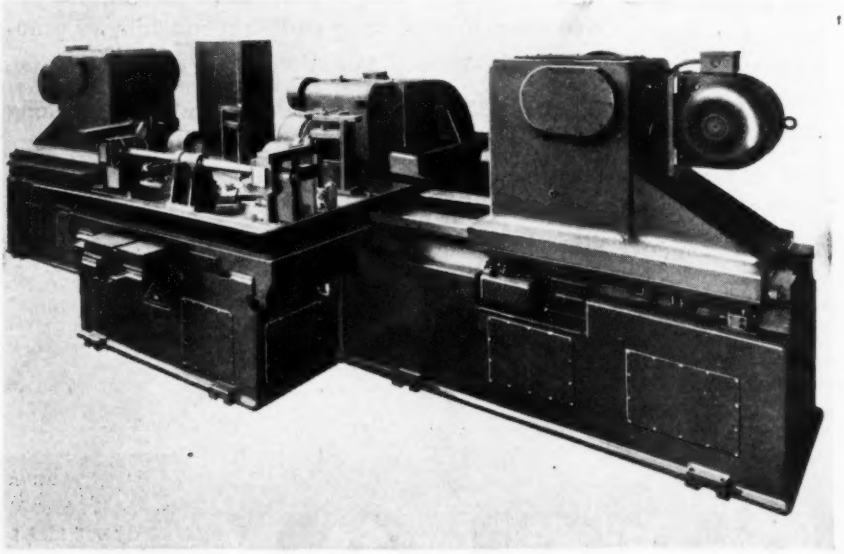
FOR HEAVY HOGGING · · · PRECISION FINISHING · · · INTERMITTENT CUTTING

Twin driving gears are employed on this reducing press to divide the torsional load between two slides and slabs of the shaft. The machine is of four-piece steel tie-rod frame construction with double gearing, and operates at a speed of 14 strokes per minute. It is equipped with a multiple-disk, flywheel type, air friction clutch and a brake with push-button control. For maximum production, a six-station dial feed is employed. The stroke of the slide is 34 inches, the slide face is 18 by 29 1/2 inches, and the bed is 36 by 36 inches.....61

LeMaire Special Three-Way Boring Machine

A special hydraulic, three-way, boring machine has just been developed by the LeMaire Tool & Mfg. Co., Dearborn, Mich. It was designed to bore and counterbore twelve holes in a cast-steel differential and final drive housing. This huge part, having a total length of 7 feet, weighs approximately 1200 pounds. The complete cycle of loading, boring, and unloading is completed within thirty minutes. This is about one-tenth the time formerly required to perform these operations on standard boring mills.

The new machine consists of a center head and two end heads. The center head has one spindle carrying a 10 1/2-inch cutter on each side. Each of the end heads has two spindles, one equipped with three cutters and the other with two cutters. This machine is designed to bore and counterbore five holes in each end of the work, ranging in size from 5.118 to 7.125 inches in diameter, while the center head bores two main bearing holes 10.501 inches in diameter, and also finishes the shoulder bearing seat. All holes are held to a tolerance of 0.0012 inch. Both end heads are fed while the center head bores one large bearing. After one of the large bearings has been bored, the center head reverses and rapidly advances to a feeding position for boring the large bearing on the opposite side.....62



LeMaire Special Three-way Boring Machine for Cast-steel Differential Housings

Ampac 400-Ampere Welder

A new welder for heavy industry, known as the Ampac 400, has been introduced on the market by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The 400-ampere capacity of this welder was chosen as ideal after an extensive investigation of the average needs of industrial welding shops under present conditions. This self-cooled unit will handle 1/4-inch electrodes under continuous operation, and has sufficient capacity for welding operations with rods up to 3/8 inch in size, when needed. The unit is also adaptable for automatic welding. A range of 50 to 500 amperes is available with power factor correction.

Ampac 400-ampere Welder Built by the Allis-Chalmers Mfg. Co.

Outstanding features include low idling loss, high power factor, and extremely high efficiency and welding characteristics over the entire welding range. The temperature rise and voltage breakdown tests exceed all the NEMA requirements. Only eight turns of the control handle are required to cover the welding range.....63

Budgit Bridge Drive for Cranes

The Budgit Products Division of Manning, Maxwell & Moore, Inc., Muskegon, Mich., has placed on the market, under the trade name Budgit bridge drive, a self-contained unit for converting the bridge travel motion of hand-operated cranes to electric drive. This is stated to be the first drive of this type to be placed on the market. Patents to cover the unit and its application are pending. The outstanding feature of the drive is that no machine work, drilling, or fitting is necessary in order to apply it. It can be installed on a crane in an hour's time, and the only tool needed is a wrench.....64

To obtain additional information on equipment described on this page, see lower part of page 198

YOUR LIFE WILL BE . . .

Perhaps you take no stock in things occult! Perhaps you wouldn't believe what this mystic might predict. And we don't ask you to. But it *is* entirely possible to peer into the future lives of rotating parts. In fact, it's being done every day—through the medium of the Dynetric Balancing Machine. And it's done for thoroughly practical reasons—to detect and correct their weaknesses in static and dynamic balance—to protect them against vibration and excessive wear—to insure the longest possible life and the most efficient service. And there's nothing mysterious about it!

At Gisholt, the Army-Navy "E" and the Treasury flag fly side by side.

GISHOLT MACHINE COMPANY
1209 E. Washington Avenue
Madison, Wisconsin

GISHOLT DYNETRIC BALANCING MACHINES *enable you to foresee the hazards which affect high speed rotating parts and to eliminate them. Electronic tubes clearly reveal unbalanced vibrations by amplifying them as much as 1,600,000 times. Literature on Dynetric Balancing is yours on request.*

GISHOLT

Look Ahead . . . Keep Ahead . . . With Gisholt Improvements

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

"Hydraulpro" Production Type Milling Machine

A line of production type milling machines, designated the "Hydraulpro," has recently been brought out by Modern Tool Works, Ltd., 69 Montcalm Ave., Toronto, Canada. These machines have been designed with three principal factors in view, namely, to provide the rigidity necessary for rapid removal of metal without sacrificing accuracy or surface finish; flexibility and simplified operation by centralization of control in a single lever; and long life.

The automatic, intermittent feed-cycle features are very flexible and are designed for high-output, continuous manufacturing on such parts as exhaust intake manifolds, cylinder blocks, etc. By means of suitable fixtures and continuous operating cycles, multiple gang-milling of such parts as multi-jaw clutches, gang-milling of spline shafts, and other types of mass production work can be handled. Features such as the gate type front over-arm brace and the slip-on type splined pick-off gears, make possible the changing of spindle speeds in less than one minute.

The arrangement of trip-dogs and the hydraulic stepless variable-feed mechanism make possible complete automatic cycles, such as rapid advance, fine feed, coarse feed, further rapid advance, fine and coarse feed again, stop, return, and repeat if desired. The electrical control is so arranged that the spindle rotation can be interlocked and synchronized with the table movements, the spindle starting with the feed advance and stopping on the completion of the cycle. The spindle can also be started independently of the table movements by simply turning a switch. Turning another switch causes the spindle to reverse its direction of rotation.

Three motors are employed to operate these machines. These machines are available in two sizes, one of which has a work-table 14 inches wide with a 36-inch longitudinal feed, while the other has a table 14 inches wide with a 60-inch longitudinal feed. The former weighs 9300 pounds, and the latter 11,000 pounds.—65

Covel Universal Cutter and Tool Grinder

A No. 12 universal cutter and tool grinder, adapted for a large variety of grinding operations required in the manufacture and reconditioning of cutting tools, reamers, boring-bars, etc., has been brought out by the Covel Mfg. Co., Benton Harbor, Mich. Convenience of operation is an outstanding feature of this machine. All controls are within easy reach of the operator and are especially designed for manipulation with minimum effort.

The table and saddle are mounted on ball bearings. The main spindle is mounted in a quill in such a manner that it can be easily renewed or removed for inspection. It has three speeds, and is driven by a 3/4-H.P. motor mounted above and to the rear of the grinding position, where it does not interfere with cup-wheel grinding operations.

A large variety of attachments are available for use in performing many different kinds of grinding operations. The longitudinal travel of the table is 18 inches, and the vertical travel of the main grinding wheel is 8 inches. Work up to 10 3/8 inches in diameter can be accommodated. The work-holding

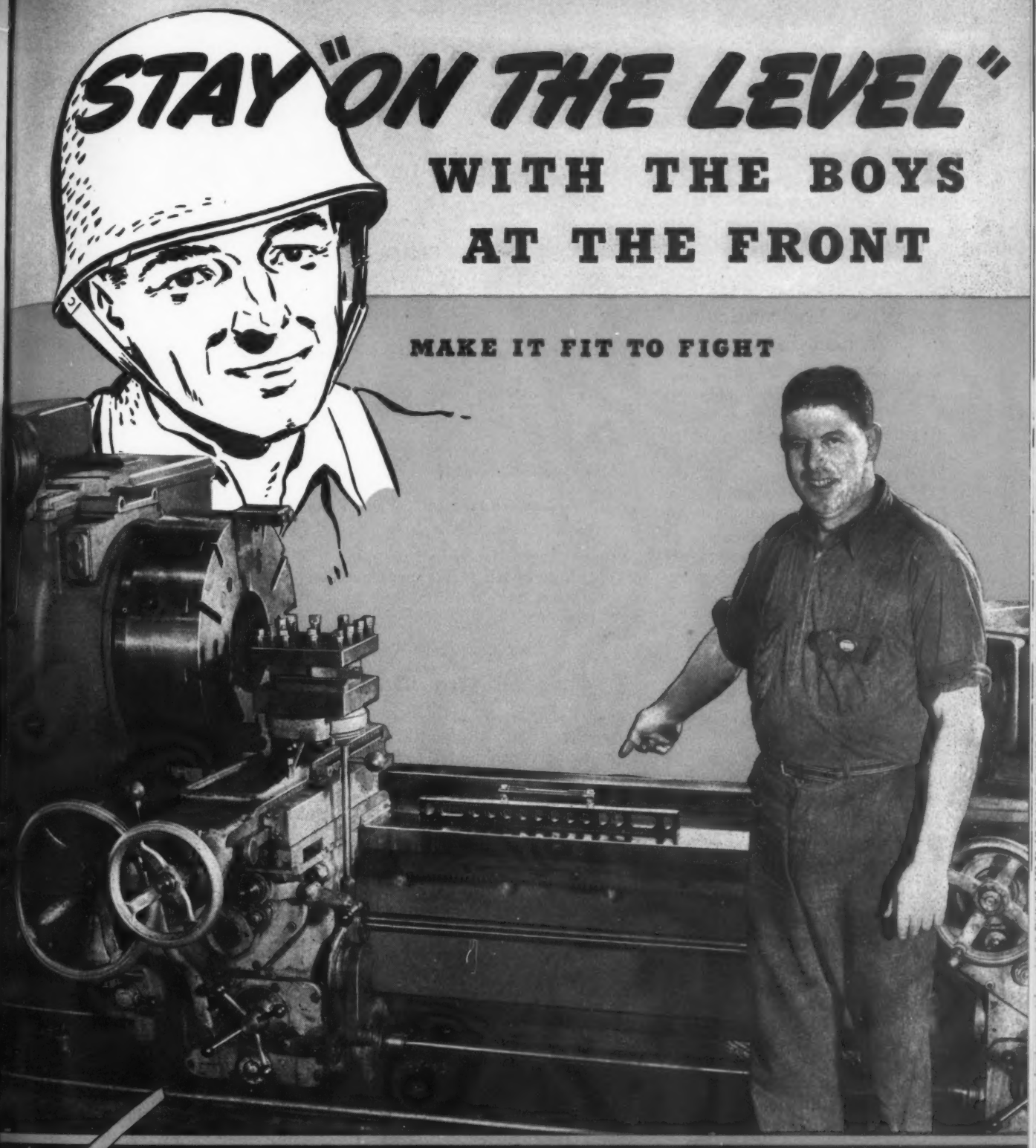
Production Type Milling Machine Brought out by Modern Tool Works, Ltd.

Universal Cutter and Tool Grinder Built by the Covel Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 184.

STAY "ON THE LEVEL"

WITH THE BOYS AT THE FRONT



ACCURACY DEMANDS . . .

KEEP YOUR TURRET LATHES LEVEL

Use only a precision level, or the cutting test for leveling your machine • *CONSULT YOUR SERVICE MANUAL*

★ *Reproductions of this page on enameled paper are available for bulletin-board use in your turret lathe department. Write the Gisholt Machine Company, 1209 East Washington Avenue, Madison, Wisconsin. Ask for the series of "War-time Care and Operation Posters." State quantity required.*

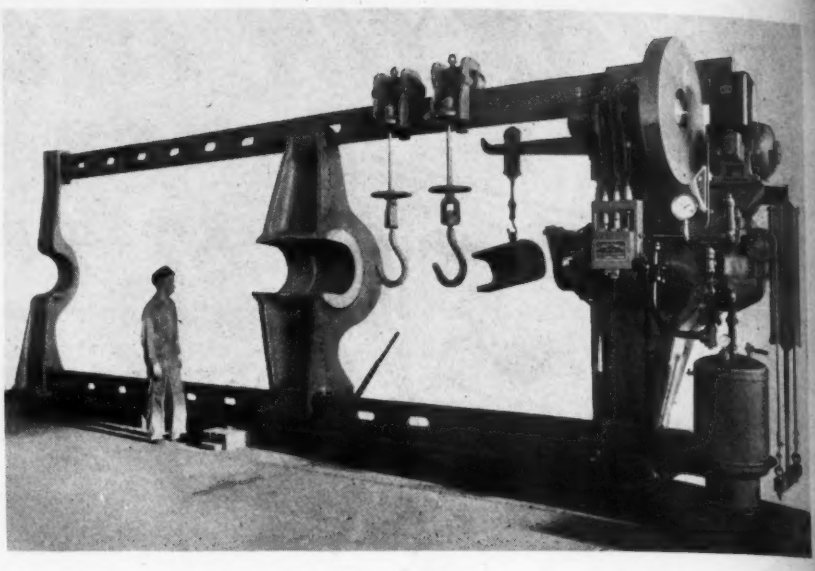
capacity between centers is 24 inches, and the grinding range 16 inches. The table working surface is 5 1/2 inches wide by 36 inches long. The vertical distance from the center of the spindle to the top of the table is adjustable from 3 to 11 inches. Three speeds of 3200, 4500, and 5800 R.P.M. are available. ---------- 66

Wood Hydraulic Wheel Press

A self-contained hydraulic wheel press with a unique pneumatic pull-back arrangement for use in railroad repair shops, machine shops, and for general industrial work has been designed by the R. D. Wood Co., Philadelphia, 5, Pa. The pneumatic pull-back device eliminates the necessity of providing a pit for counterweights and gives a faster rate of ram return than the customary ballast weight.

Openings of 10-inch radius are provided in the resistance post and the end post to accommodate the work. The resistance post operates on rollers on the machined face of the baseplate, thus assuring easy movement in either direction. A recess having an 11-inch radius has been provided in the resistance post in which a stop-plate can be inserted if necessary.

The pump is of the vertical triplex two-pressure type. The ram has a travel of 26 inches, and its approach speed is 70 inches per minute. Ram speed at low pressure is 10 inches per minute, and at high pressure 3 1/4 inches per minute. The return speed is 40 inches per minute. Maximum capacity at high pressure is 600 tons, and at low pressure, 100 tons.---67



Self-contained Hydraulic Wheel Press Built by the R. D. Wood Co.

Di-Acro "Double-Action" Bender

The O'Neil-Irwin Mfg. Co., 332 Eighth Ave. S., Minneapolis, 15, Minn., has recently added to its Di-Acro line a No. 3 "double-action" bender especially designed for aircraft and marine work. This bender can be used to form or duplicate all types of tubing, channel, angle, or I-shaped sections, as well as round, square, flat, or other shapes of solid or open cross-section materials. Moldings and various other materials of partially open or irregular outline can also frequently be formed to the same tolerances as are specified when production dies are used.

The Di-Acro No. 3 bender incorporates all the operating characteristics of the Di-Acro benders Nos. 1 and 2. It has the same wide forming range as the previous benders plus the capacity for forming work to larger diameters. This precision-built standardized unit is so designed that it can be readily converted into a specialized bender capable of forming all types of regular- or irregular-shaped materials, including spring-tempered metals within their ductile limits.

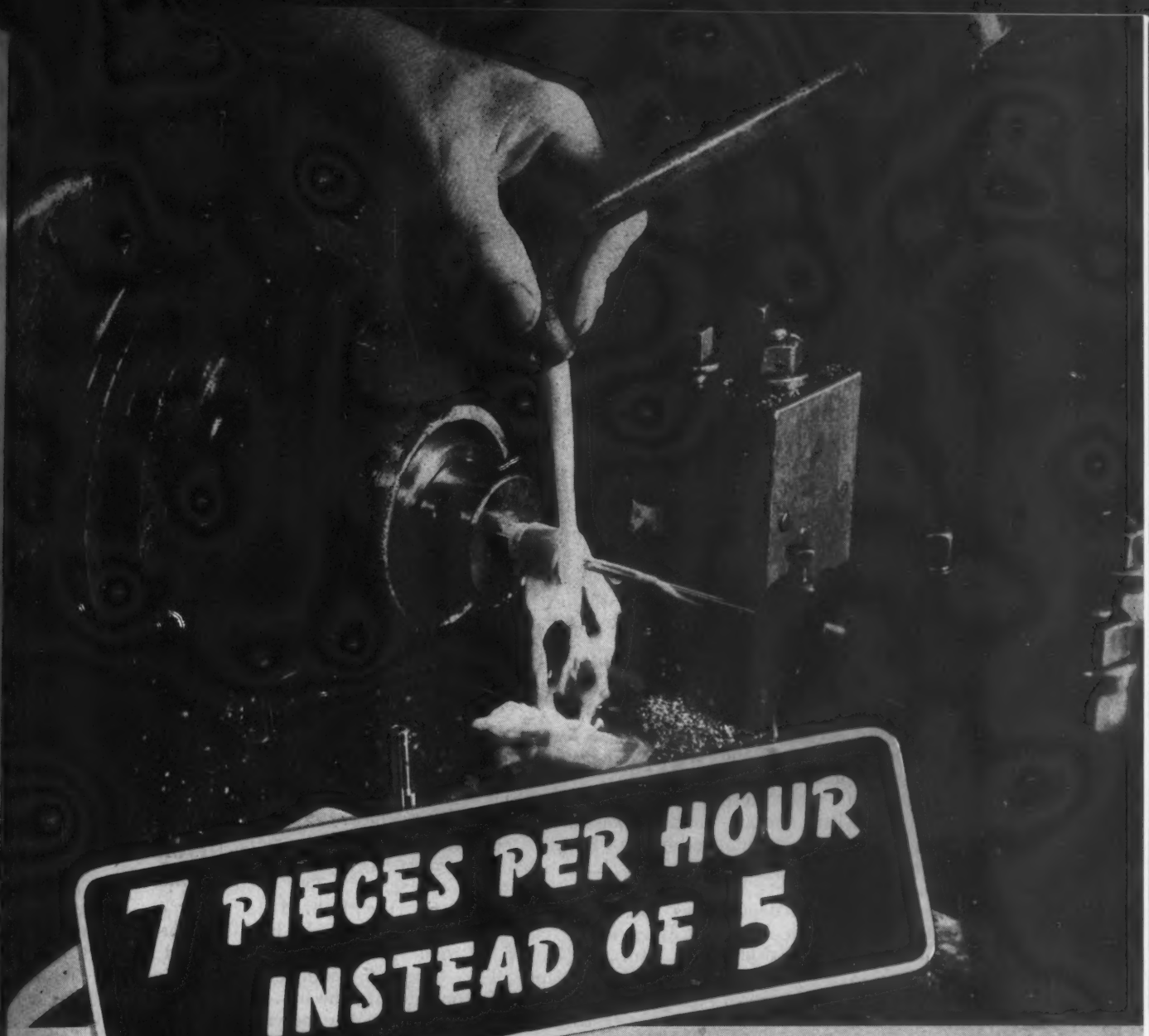
The length of the operating leverage is 35 inches, but it can be readily increased to 80 inches. The bender has a capacity for cold forming 1/2-inch round cold-rolled steel bar stock to a 1 inch radius or larger. It weighs 215 pounds.---68

"Double-action" Di-Acro Bender Developed by the O'Neil-Irwin Mfg. Co.

Carbide Rotary Cutters

The M. A. Ford Mfg. Co., Inc., 737 W. First St., Davenport, Iowa, has recently added ten sizes of carbide rotary cutters to its line of

To obtain additional information on equipment described on this page, see lower part of page 184.



SUNOCO EMULSIFYING CUTTING OIL

...boosts cutting tool life 40%...speeds production...improves finish

Here's one plant where vital parts for war machines are being produced in almost half the time it used to take . . . thanks to Sunoco Emulsifying Cutting Oil.

According to reports slow speeds were necessary because of excessive heating and smoking. Tools wore rapidly. Cutting oil costs were high. Then a Sun Doctor of Industry was called in. At his suggestion a switch was made to Sunoco. In one week, results were remarkable. With Sunoco's high heat-absorbing and lubricating qualities, speeds were increased. Seven parts were produced each hour instead of the former five . . . making possible 16 "extras" per day with no increase in tool grinding. Finishes were noticeably finer. And all at a saving of 10% in cutting oil cost.

This is only one of many cases where Sunoco Emulsifying Cutting Oil is speeding the production pace of American industry in its race with War. Probably a similar speed-up can be accomplished in your plant. Call in a Sun Oil Company Engineer—write or phone your local Sun office.

SUN OIL COMPANY, *Philadelphia*

Sun Oil Company, Limited . . . Toronto, Canada

SUNOCO

SUN INDUSTRIAL PRODUCTS

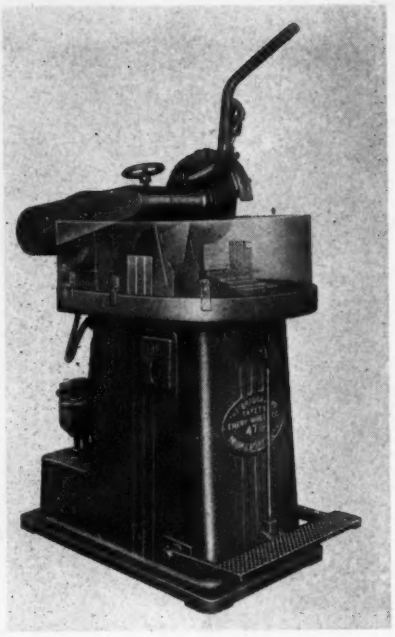
HELPING INDUSTRY HELP AMERICA

rotary files and cutters. These new cutters are made to give longer service in machining the hardest metals. In some instances, they have been found to outlast ordinary high-speed steel cutters by as high a ratio as 100 to 1, cutting faster and, of course, with proportionately fewer regrinds. Each of the ten sizes of carbide cutters is made in five different shapes.....69

"Tri-Bit" Face Mills

A new type of cutter blade known as "Tri-Bit" has been applied to face milling cutters by Weddell Tools, Inc., 1239 University Ave., Rochester, N. Y. These Tri-Bits are triangular-shaped, each being securely locked in a V-shaped hole in a heat-treated cutter body by a single locking screw. The cutter body is tied together entirely around the blade, there being no slots to spring away or tear open. Each Tri-Bit is further backed up by a single adjusting screw, which permits minute adjustment of the blade to 60 per cent of its length.

Face mills are made with three different sizes of Tri-Bits for medium, heavy, and extra heavy duty operation. These three sizes are intended, respectively, for cuts up to 1/4, 1/2, and 3/4 inch in depth. Cutters are furnished with high-speed steel, cast alloy, or carbide-tipped Tri-Bits. They are made to standard or special specifications, with any desired number of Tri-Bits set at suitable cutting angles for any material.....70



"Abrasaw" Cut-off Machine Made by Bridgeport Safety Emery Wheel Co.

"Abrasaw" Cut-Off Machine

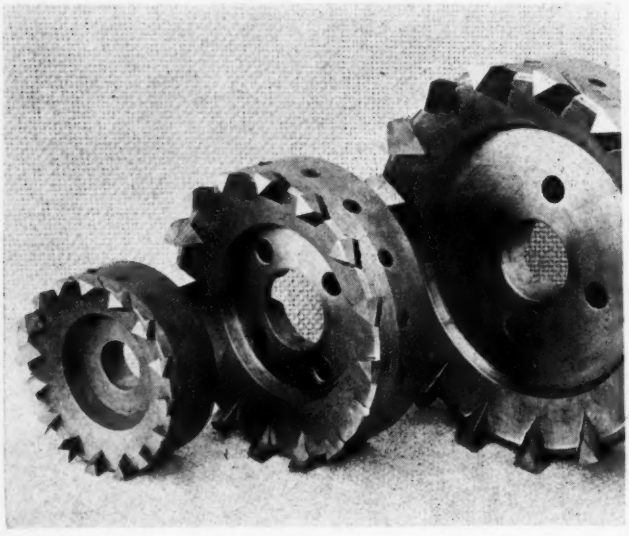
A 47 P streamline "Abrasaw" cut-off machine, in which all the desirable features of the 47 W machine have been incorporated, together with many improvements, has been brought out by the Bridgeport Safety Emery Wheel Co., Inc., 1271 W. Broad St., Bridgeport, Conn. The base of this new machine now consists of a single casting. This permits the large coolant tank to be placed in the base and the coolant pump to be mounted on the rear of the machine.

Automatic coolant control is supplied as regular equipment. For laboratory work or other uses where production speed is not so essential, the machine can be furnished with hand coolant control. The cutting head is practically the same as that used on the 47 W machine. Vises can be furnished for straight cuts only or for combination straight and angle type cuts. The vise for straight cuts can now be furnished for foot-treadle operation at a small additional cost.

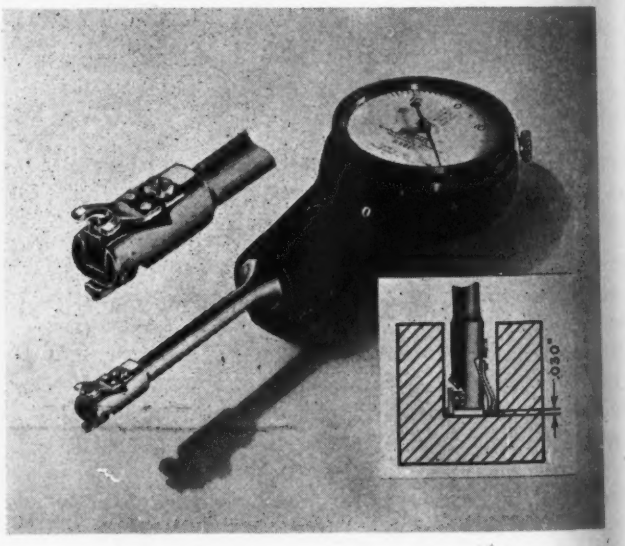
The machine has a capacity for cutting solid bar metals up to 1 inch, and tubing and light sections up to 2 inches. It is equipped with a 5-H.P. ball-bearing motor. Abrasive cutting disks up to 12 inches in diameter, from 1/16 to 1/8 inch thick, with a 1-inch arbor hole can be used. The coolant pump is driven by a 1/4-H.P. motor. The machine requires a floor space of 28 by 50 inches, and with the angle type vise weighs 1290 pounds.....71

Federal Centralizing Type Blind-Hole Gages

The Federal Products Corporation, 1144 Eddy St., Providence, R. I., has developed a new blind-hole gage designed to check inside diameters to within 0.030 inch of the bottom of the hole, as indicated in the view in the lower right-hand corner of the accompanying illustration. These gages are highly



"Tri-Bit" Face Mills Placed on the Market by Weddell Tools, Inc.



Centralizing Type Gage for Blind Holes, Made by Federal Products Corporation

To obtain additional information on equipment described on this page, see lower part of page 184.

SIDNEY LATHES

Precision Built

12 Speed Model

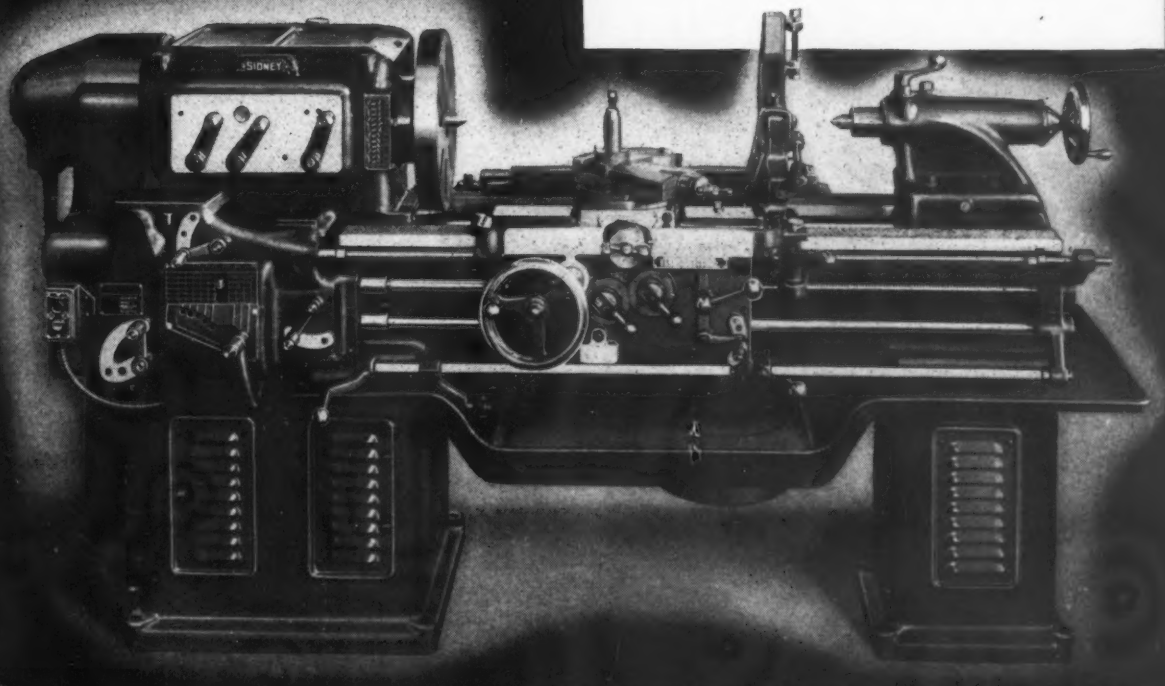
SIDNEY

THE SIDNEY MACHINE TOOL CO., SIDNEY, OHIO, U.S.A.

● These sturdy, precision built lathes have twelve selective spindle speed changes without the use of jaw clutches. These changes are obtained through accurately cut spur gears of chrome molybdenum alloy steel, heat treated, hardened, shaved and cross-axis machine lapped. The sliding gears have rounded teeth, and staggered to permit of easy engagement. The gears slide on ground multiple splined shafts with integral keys. All shafts turn on anti-friction bearings. The Spindle is mounted on precision tapered roller bearings.

These are a few of the many precision points in construction that result in more accurate work—greater production—easier handling.

The 12 speed model is currently available in a size range from 14″ to 20″ inclusive.



The **SIDNEY MACHINE TOOL** *Company*

Builders of Precision Machinery

SIDNEY ESTABLISHED 1904 OHIO

sensitive and accurate, internal operating friction, lost motion, and wear having been practically eliminated by the spring-suspended construction of all moving parts in the gaging head. This type of head has no bearings or bushings. Gages of this construction can be used under adverse conditions; a small amount of oil, coolant, or dirt in the gaging head, for example, does not affect the accuracy or sensitivity of the gage.

Two auxiliary locating contacts centralize the measuring contacts diametrically across the center of the hole. A slight rocking motion is required to locate the contacts at right angles to the walls of the hole in all positions except at the bottom of the hole. The gage measures the diameter by direct contact, and can be easily set to a master, gage-blocks, or a micrometer. The Model 1201 P-20 gage has a total range for measuring holes from 0.500 to 0.750 inch in diameter. The 1201 P-21 gage will measure holes from 0.750 to 1.250 inches in diameter. 72

Power Feed with Electronic Control Developed for Reed-Prentice Machine

One of the first applications of electronic control to machine tool feeds has been developed for use on the No. 4 vertical milling machine built by the Reed-Prentice Corporation, Worcester, Mass., which was described in March, 1942, MACHINERY, page 161.

This new power down feed, controlled by an electronic speed and torque regulator, is intended for either drilling or boring operations. It embodies advantages that are entirely new in the machine tool field, although its operation has been thoroughly tested and proved in other applications. The compact electronic unit, mounted on top of the cross-slide, is shown in Fig. 1. The simplified control station, designed for convenient mounting near the spindle head of the vertical miller, is shown in Fig. 2.

The electronic regulator controls a 1 1/2-H.P. direct-current motor that provides a smooth, continuous, infinitely variable feed to the vertical head. The electronic unit and controller operate on 50- or 60-cycle single-phase current in the range between 200 and 600 volts. The circuit has an inherent safety factor that provides a natural increase or decrease in motor speed for maintaining the selected feeding rate.

The control automatically holds the feed to within a fraction of the desired R.P.M. The circuit is self-braking when the control lever is set to the "Stop" position. Overload protection is supplied for the feed drive in the event of stalling or jamming.

All controls are mounted on a single panel. The feed rate is selected by a convenient control calibrated to provide any feed desired from 1/2 inch to 15 inches per minute. The feeding rate can be adjusted without stopping the machine or withdrawing the tool.

The movement of a single lever controls the stopping and up and down movements of the head. Safety stops are provided to prevent over-travel, while adjustable dogs on the four-position turret-stop confine the head travel within the work limits. Rapid traverse at the maximum feeding rate is approximately 40 inches per minute. The rapid traverse is obtained by pushing the "Fast" button on the control panel. 73

Manning, Maxwell & Moore Chain Hoists

The Budgit Chain Block Division of Manning, Maxwell & Moore, Inc., Muskegon, Mich., has brought out a new line of high-speed spur-gear chain hoists with from 1/4 to 2 tons lifting capacity. These hoists are of entirely new design and of unusually light weight. Those of 1/4- and 1/2-ton lifting capacity weigh 48 pounds; the 1-ton hoist weighs 59 pounds; and the 2-ton hoist, 81 pounds. 74

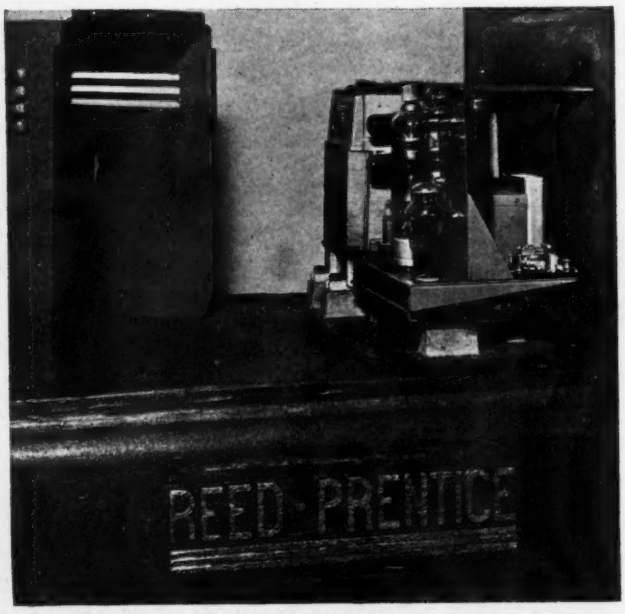


Fig. 1. Electronic Control Unit of Down Feed for Reed-Prentice Vertical Milling Machine

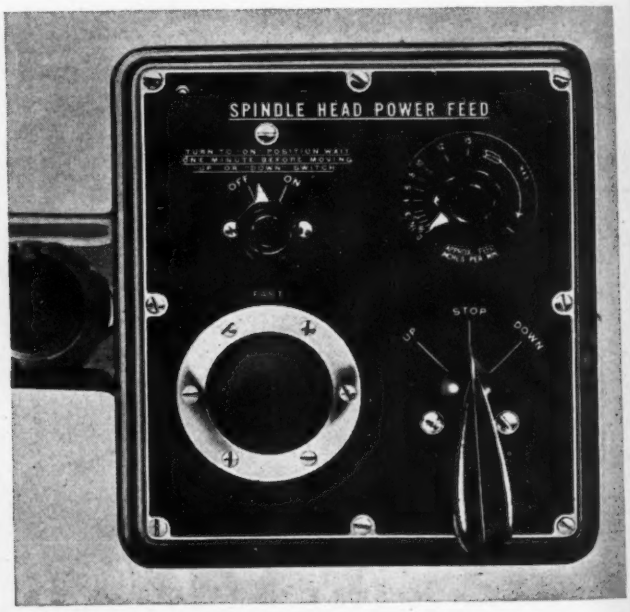


Fig. 2. Simplified Control Station Employed with Electronic Control Unit Shown in Fig. 1

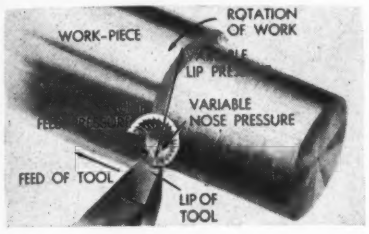
To obtain additional information on equipment described on this page, see lower part of page 184.

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

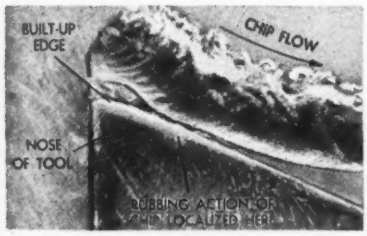
HOW TO SOLVE OPERATING PROBLEMS WITH *Correct Lubrication*

How Cutting Oil Can Increase Your Production:

1 FACTS ABOUT METAL CUTTING



The lip of a tool is an *extreme-pressure* area where the great pressures of the chip are exerted. At the tool nose and directly below the cutting edge is a *boundary area* which intermittently contacts the work-piece as the tool is deflected by the varying pressure of the chip. These microscopic vibrations create minute openings permitting a properly selected cutting oil to reach the pressure areas.



The *built-up edge* (see above) protects the cutting edge of the tool from frictional heat and excessive wear. An excessive build-up, however, results in its sloughing between tool and work-piece, thus marring the finish.

2 WHAT CUTTING OILS MUST HAVE (FOR GENERAL MACHINING)

PRESSURE RESISTANCE

Adequate pressure-resisting property in a cutting oil prevents excessive heating and wear of cutting tool and promotes smooth chip flow. RESULT: *Maximum feeds and cuts... minimum vibration... satisfactory finish.*

ANTI-WELD

Correct anti-welding property prevents excessive amount of built-up edge which can slough between tool and work, but fosters the necessary slight build-up which protects the cutting edge. RESULT: *Satisfactory finish* and *long tool life.*

LUBRICITY

Correct lubricity protects the boundary area of the tool from excessive wear. RESULT: *Long tool life... accurate size...smooth finish.*

COOLING ABILITY

Maximum cooling ability to remove frictional heat. RESULT: *Maximum speed...long tool life.*

3 PRODUCTION BENEFITS FROM USING S/V CUTTING OILS:

S/V Cutting Oils are the highest quality obtainable for the service for which they are recommended. They have a correct balance of essential cutting oil properties and their use results in...

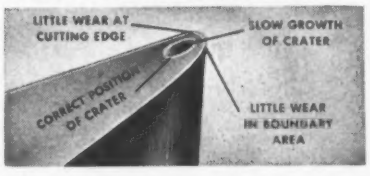
✓ **MAXIMUM CUTTING SPEEDS, FEEDS, CUTS—**
i.e., a maximum amount of metal removed per minute.

✓ **MAXIMUM PRODUCTIVE MACHINE TIME—**
i.e., minimum shut-downs for tool replacements.

✓ **MINIMUM REJECTS—**
due to poor finish or off-size.

Plus

✓ **TOOL CONSERVATION**



The picture above shows the best position of the crater on the lip of the tool. It results in the need for removing only a minimum of metal per grind. If finish and tool life are satisfactory, this is the ideal condition.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC.—Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California

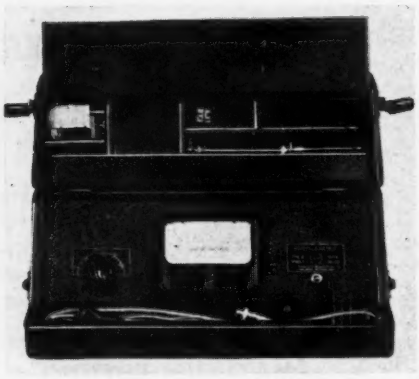
USE S/V CUTTING OILS

S/V VACSUL · S/V SULTRAN · S/V VACMUL

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

Profilometer for Accurate Measurement of Surface Roughness

A new profilometer—the Type Q—has been brought out by the Physicists Research Co., 343 S. Main St., Ann Arbor, Mich. Like the earlier type profilometers, the new model is designed to provide extremely accurate measurements of surface roughness by direct dial readings. This instrument is much lighter and smaller than previous models, and can be used more conveniently wherever needed. As shown in the illustration, the new



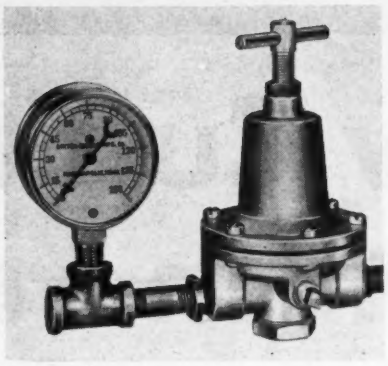
Profilometer for Measuring Surface Roughness, Made by the Physicists Research Co

carrying case has storage compartments for various accessories, including the Type M tracer, Flex-arm, glass specimen, and Type I or J tracer. Power and tracer cables are stored in a compartment in front of the panel.

This profilometer is designed for use on 115- or 230-volt, 50- to 60-cycle power lines. In operation, the tracer is simply moved either manually or automatically over surfaces of practically any size, shape, or degree of roughness, the information required being indicated immediately in true inch units on the instrument dial. No computations or other scaling operations are necessary. 75

Combination Reducing Regulating Valve and Pressure Gage

The Dayton Rogers Mfg. Co., 2835 Twelfth Ave., S., Minneapolis, Minn., has brought out an improved design of regulating valve



Dayton-Rogers Combination Air Regulating Valve and Pressure Gage

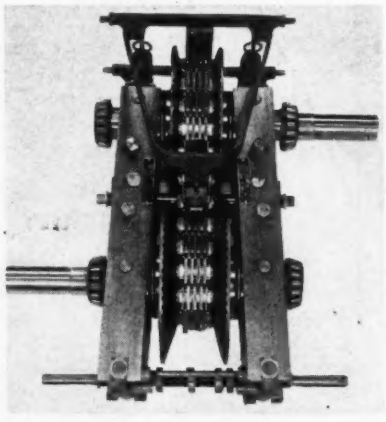
that can be supplied with a pressure gage for reducing air in the average shop air-lines to the desired working pressure. These regulators are equipped with a new special compound spring mechanism which provides sensitive, instantaneous control of the pressure.

The diaphragm of this valve is designed to assure sensitive opening and closing of the ports, thus preventing grating, chattering, and fluctuations in the air pressure. The regulator is now manufactured in two sizes for 1/4- and 3/4-inch iron pipe fittings. 76

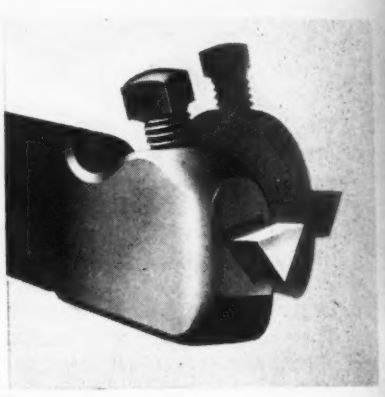
Variable-Speed Mechanism for Built-in Machine Tool Applications

The Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, 40, Pa., has announced that the company is now prepared to furnish P.I.V. variable-speed mechanisms without the usual housings for use as built-in integral units of machine tools. These bare Link-Belt mechanisms, together with the technical information supplied by the manufacturer, enable the machine tool designer or engineer to incorporate the variable-speed transmissions in the machine design as an integral unit. In some instances, it is even possible to have the variable-speed mechanism built in so that it will run in the same oil case or reservoir with the change-gear sets.

The operating speed of the P.I.V. mechanism shown in the illustration can be regulated by a handwheel or lever. The bare mechanism units are available in sizes and speed-range capacities to meet the requirements of drilling machines, lathes, and other machine tools. Scales and dials are available which simplify the problem of selecting exactly the right speed for a given job. 77



Variable-speed Mechanism Furnished without a Housing for Built-in Construction



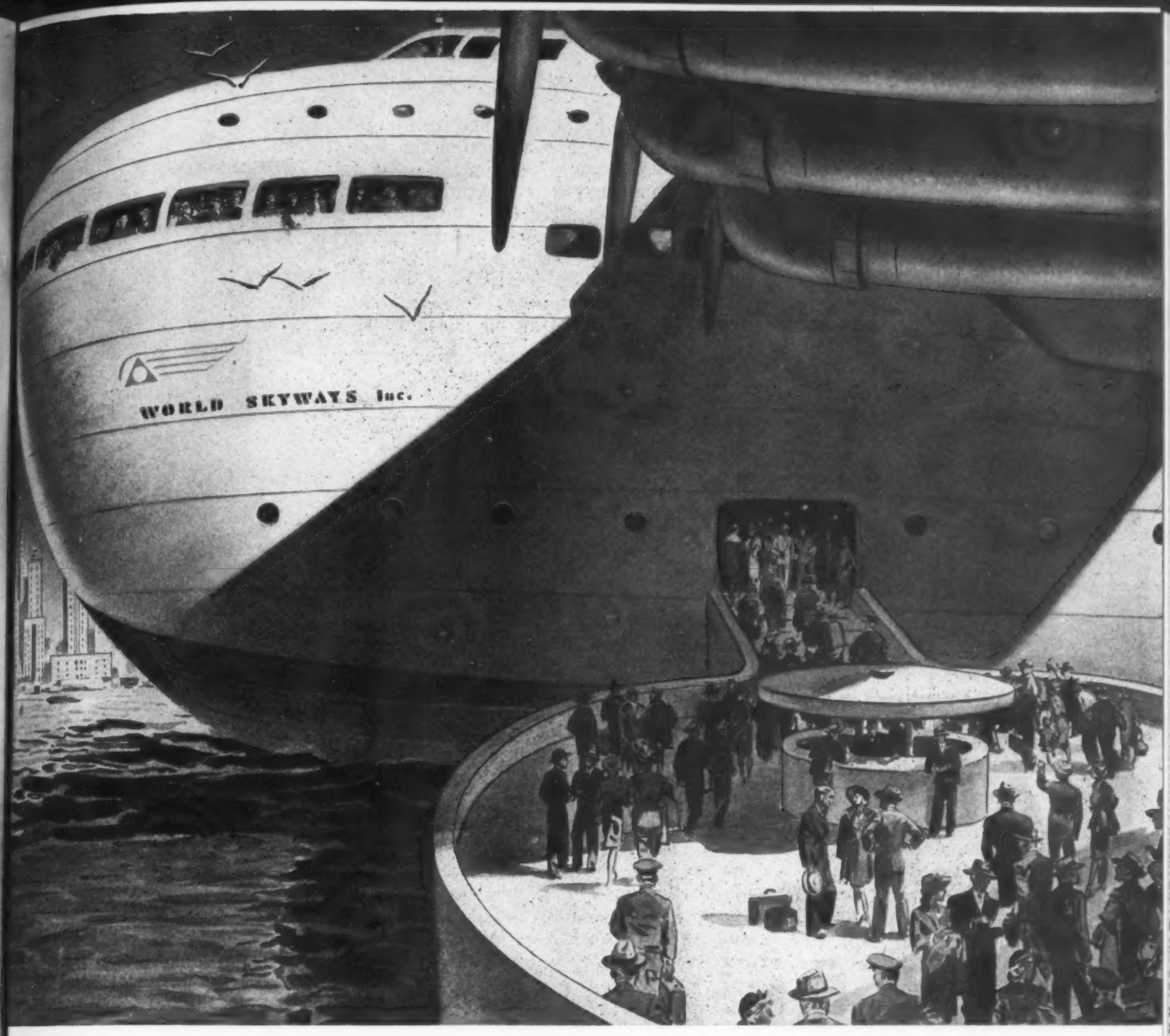
Tool Bit and Holder Made by the Triangle Tool Co.

Triangle Tool Bits and Holders

The Triangle Tool Co., 2104 E. 22nd St., Cleveland, Ohio, has developed an entirely new design of tool-holder and bits with the object of conserving high-speed tool steel, and at the same time, insuring longer tool life. The new bits are triangular in shape and are held rigidly by a triangular seat in the tool-holder. It is claimed that this feature practically eliminates vibration and tool chatter in the holder, permits greatly increased machine speeds, and reduces tool wear resulting from friction and vibration.

The triangular-shaped bits are

To obtain additional information on equipment described on this page, see lower part of page 184.



BETTER GEARS FOR TOMORROW'S SKYLINERS

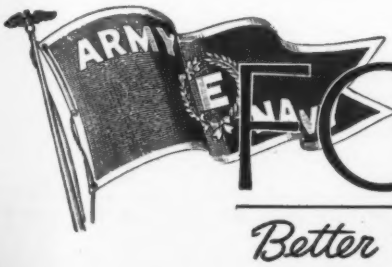
A new era in transportation is on the way! Already skyliners of the future are past the experimental stage, and tomorrow promises a world of short distances—a world where Bagdad and Cairo, Moscow and Budapest will be little more than sleeper jumps from New York.

The giant engines to power these airliners of the future are today a reality. The war's end will find them ready to take over the transportation problems of a world at peace.

Making gears for these engines is Foote Bros.' job. And these gears represent a new advance, both in gear design and gear manufacture. For transmitting the great loads developed by modern aircraft engines demands heretofore unheard-of standards of precision—a precision that must, of necessity, be coupled with extreme lightness. Today these gears are rolling off Foote Bros.' production lines in amazing quantities—gears that mark a revolutionary development in the transmission of power.

When the war is won and these new gears can be produced for peacetime industry, they give promise of new efficiency—new economy to American manufacturers, whether they be applied to skyliner engines or machine tools, farm machinery or motor cars.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago, Illinois



FOOTE BROS.

Better Power Transmission Through Better Gears

chromium-plated by the Lundbye process. Four grades of high-speed tool-steel bits and three standard model tool-holders are available in all regular sizes. Each bit can be used to perform three basic cutting operations.

Right- or left-hand cutting can be performed with the same bit without additional grinding. The same bit, turned end for end, requires no extra adjustment for square cutting operations. These features reduce "down time" for change-overs and allow one tool bit to do the work that ordinarily requires three tools, thus eliminating the need for a large stock of tool bits. Only one flat grind across the face of the triangular bit is required to maintain the correct rake and clearance angles. This simple grinding operation is easily performed by inexperienced machine operators. ---- 78

Lever Type "Precision" Cross-Slide

A "Precision" lever type cross-slide having a capacity of 2 1/2 inches has recently been developed by the General Die-Stamping-Tool Co., 265 Canal St., New York, 13, N. Y., for use on small lathes. Several new features have been incorporated in this cross-slide, which is ruggedly constructed to insure smooth operation and freedom from "lift." The top lever arrangement serves to increase sensitivity and eliminate chatter. Double leverage is obtained by linkage. The handle is adjustable to three positions to suit the convenience of the operator.

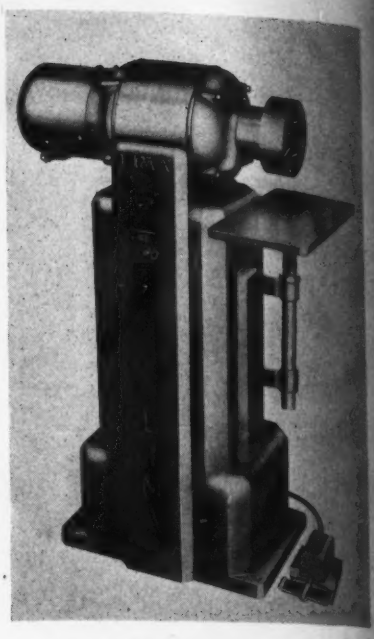
The two toolposts, which accommodate bits from 1/4 to 7/8 inch, are equipped with a new tool-leveling device that maintains the tool in a horizontal position, in such a manner that it is instantly adjustable. The Precision lever type cross-slide is available in three models for use on 10-inch Atlas and Logan lathes and on 9-inch South Bend lathes. It can, however, be made to fit most other bench lathes. ---- 79

Lima Magnetic Polishing Lathe

The Lima Electric Motor Co., 1801 Findlay Road, Lima, Ohio, has developed a magnetic polishing lathe designed to solve difficult work-holding problems in polishing, burring, or lapping operations on steel and other ferrous metal parts. This polishing lathe is designed to speed up production by providing an effective means of holding odd-shaped parts or sections. It is suitable for holding highly finished parts, since it leaves no clamping marks. Parts 1 1/2 inches in diameter and larger can be held in the chuck.

The new machine is furnished with either single- or two-speed motors, of two or three phase, having speeds up to 3600 R.P.M. A self-contained rectifier unit provides direct current to the chuck. Interchangeable faceplates and registering plugs adapt it for holding various types and sizes of work. It can be supplied in either a pedestal or bench type.

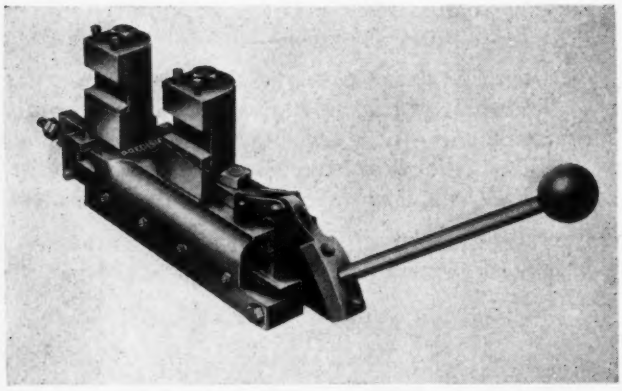
This lathe is equipped with a foot-pedal control which can be located in any convenient position. With this control, the chuck can be magnetized, the motor started and stopped, and the chuck demagnetized, thus leaving the operator's hands free for handling the work. A magnetic disk type brake for rapid stopping of the motor and chuck is supplied as standard equipment. ---- 80



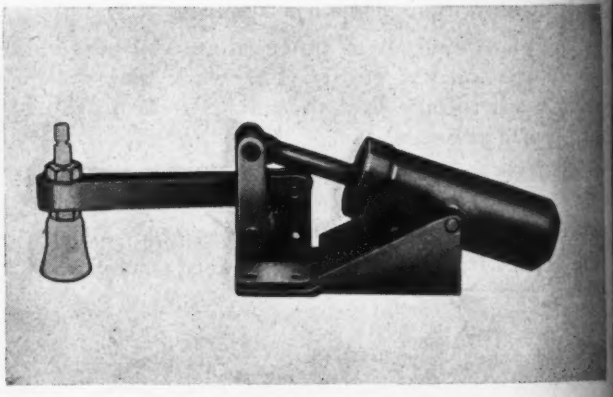
Lima Polishing Lathe Equipped with Magnetic Chuck

"Airop" Toggle Clamp

A new air-operated toggle clamp developed to hold down large parts or assemblies where clamps are required to encircle a job, as in the case of airplane wings, has been introduced to the trade by Airop, Inc., Dearborn, Mich. This device will be marketed under the name "Airop." A gang of Airop clamps placed around an extensive perimeter can be controlled from one central valve, all the clamps being



Lever-operated Cross-slide Developed for Small Lathes by General Die-Stamping-Tool Co.



"Airop" Toggle Clamp Designed for Multiple Clamping with Remote Control

To obtain additional information on equipment described on this page, see lower part of page 184.

STANDARD MARKINGS FOR GRINDING WHEELS

Approved by the American Standards Association, January, 1943

The object of this standard is to simplify the ordering and stocking of wheels and promote cooperation between wheel users and manufacturers in selecting wheels adapted to different types of work. The standard marking consists of six parts or symbols. The general meaning of each symbol and the order or sequence in which they are written are as follows:

(1) Abrasive; (2) grain size; (3) hardness or grade; (4) structure or density; (5) bond or bonding process; (6) manufacturer's record.

The following is a typical wheel marking with six symbols which represent the six characteristics listed above, and in the same order:

B 46 M2 5 V E

The meaning of each letter or symbol in this or any standard marking is as follows (the numbers 1 to 6, indicate the order):

1. *Abrasive Letters*—A, aluminum oxide, regular; B, aluminum oxide, refined; AB, mixture of regular and refined aluminum oxide or semi-friable abrasives; C, silicon carbide, regular; CG, silicon carbide, refined; D, corundum; E, emery; F, garnet.

2. *Grain Size Numbers*—These are the standard grain or grit sizes, such as 8, 10, 12, 14, 16, 20, 24, 30, 36, 40, 46, 50, 54, 60, 70, 80, 90, 100, 120, 150, 180, 220, 240, etc. For straight grain wheels, the nominal grain or grit size is given. For combination wheels, the grain size number is followed by a suffix number which may be either No. 1, 2, 3, or 4. This suffix number is based upon the relation between the average grit size in a combination and the nominal grit size. The larger suffixes do not necessarily indicate finer finishes. Combination wheels are used either to increase the strength, to produce a larger number of pieces per wheel dressing, or to obtain some other desirable characteristic.

3. *Hardness or Grade*—The wheels are divided into three general groups as follows:

Standard Grade Scale

Soft	Medium	Hard
S1	M1	H1
S2	M2	H2
S3	M3	H3
S4	M4	H4
S5	M5	H5
S6	M6	H6
S7	M7	H7

4. *Structure*—The preferred numbers are 2, 5, 8; the available numbers include 1, 3, 4, 6, 7, 9. (No. 1 represents the greatest density, No. 5 is medium, and No. 9 is the most porous or open.)

5. *Bond or Bonding Process*—The letters used are as follows: V, vitrified; S, silicate; E, shellac or elastic; R, rubber; B, resinoid (synthetic resins such as Bakelite, etc.); O, oxychloride.

6. *Manufacturer's Records*—Each grinding wheel manufacturer may use the sixth position for a symbol representing private factory records.

The grinding wheel manufacturer's old or individual system of marking may be placed below the standard marking.

MACHINERY'S Data Sheet No. 499, October, 1943

BRITISH STANDARD SOFT SOLDERS WITH REDUCED TIN CONTENT

Five Grades of Soft Solder with Reduced Tin Content Recommended by British Standards Institution to Conserve Tin and Take Place of Twelve Grades Previously Specified.—Percentage of Lead is Not Specified in Table, but Accounts for the Remainder of the Composition

British Standard Grade	Use for which the Solder is Primarily Intended*	Tin, Per Cent		Antimony, Per Cent		Impurities†		
		Max.	Min.	Min.	Max.	Iron, Per Cent Max.	Arsenic, Per Cent Max.	Total, Per Cent Max.
C	Tinsmiths' and coppersmiths' fine work, and general work	40.0	39.0	2.0	2.40	0.02	0.05	0.25
D	Lead cable wiped joints and plumbers' joints	30.0	29.0	1.0	1.70	0.02	0.05	0.25
G	General electrical purposes, tinned electrical joints. Zinc and galvanized iron work	42.0	41.0	—	0.40	0.02	0.05	0.25
M	Special tinsmiths' fine work and hand soldering	45.0	44.0	2.3	2.7	0.02	0.05	0.25
N	Dipping solder for radiator manufacture, etc.	18.5	18.0	0.75	1.0	0.02	0.03	0.25

*When solders with lower percentages of tin are now in satisfactory use for any of the purposes given in this table, their use can be continued.

†The amount of aluminum, zinc, or cadmium must be so small as not to be determinable in ordinary routine chemical analysis.

MACHINERY'S Data Sheet No. 500, October, 1943

MACHINERY'S HANDBOOK

The "Bible" of the Mechanical Industry

MACHINERY'S Handbook contains 1815 pages of mechanical tables, rules, formulas and general data needed wherever machines, tools or other mechanical appliances are designed and constructed. It is reliable, complete, and simple in arrangement and is full of standard data and thoroughly practical information.

Shop men, as well as engineers and designers, find MACHINERY'S Handbook invaluable. It contains the kind of information that is required every day in manufacturing and designing departments.

Price $6—
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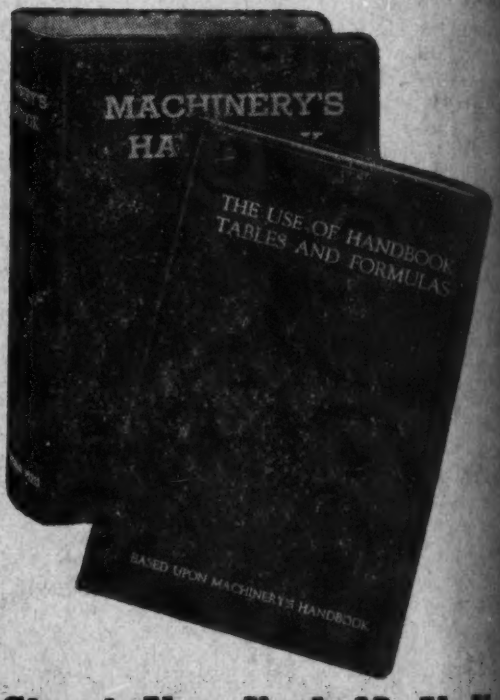
THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

THE USE OF HANDBOOK TABLES AND FORMULAS

A companion book which shows you how to get the most out of MACHINERY'S HANDBOOK

This companion book, which costs only $1, serves three purposes: It throws the spotlight on a lot of essential time-saving tables, rules and general information in MACHINERY'S Handbook that the ordinary user never discovers.

A second and equally important function is to show by examples, solutions and test questions, typical applications of handbook matter in both drafting rooms and machine shops. A third object is to provide test questions and drill work designed for use in technical schools and machine-shop training courses so that students will learn at the outset how to apply an engineering handbook.

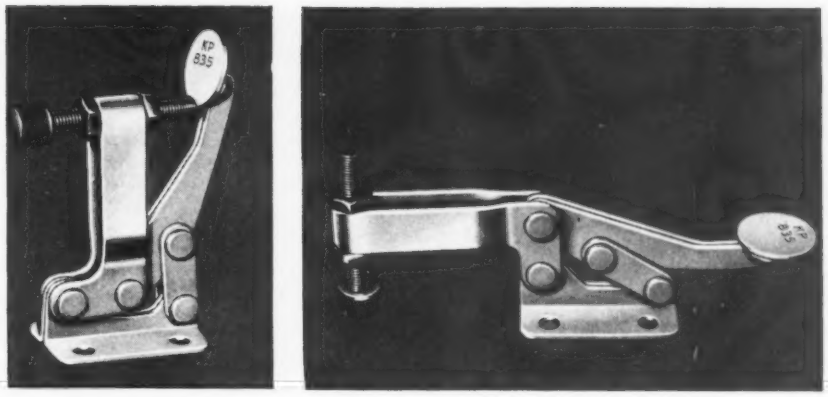


203 Pages, 63 Illustrations, 500 Problems, Exercises, Test Questions, Price $1; with MACHINERY'S HANDBOOK, $7.

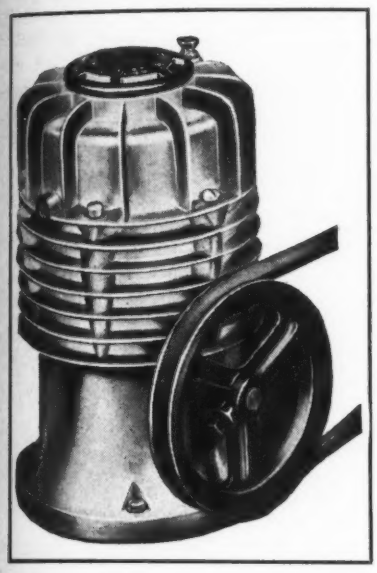
THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

made to operate simultaneously or at staggered intervals according to the requirements of the work. The control valve can be arranged for foot operation, thus leaving both of the operator's hands free to handle the work.

The clamp operates on the regular shop air-line pressure of 40 to 150 pounds. In the locked position, the toggle action is capable of holding a constant pressure of 325 pounds at the end of the clamping bar. A 90-degree swing of the clamping bar from the closed to the open position facilitates loading and unloading the work. The clamp weighs only 1 3/4 pounds, and can be used where space is limited. 81



Toggle Clamp Brought out by Knu-Vise, Inc.



Improved Air Compressor Built by W. R. Brown Corporation

Brown Improved Air Compressor

The small but powerful air compressor manufactured by the W. R. Brown Corporation, 5720-L Armitage Ave., Chicago, 39, Ill., which has recently been improved and developed to meet new standards of compactness, lightness, and efficiency, is now available for installation on equipment and machinery requiring compression or vacuum units. It delivers 2 cubic feet of free air per minute at pressures up to 45 pounds, and will produce vacuums up to 25 inches.

An important feature of the new design is the elimination of heavy, oily pistons and rings. Instead, long-life, multiple-ply diaphragms are used, which, in addition to effecting savings in weight, assure clean, oil-free air at all times. This air compressor will operate in any position, and requires a 1/4-H.P. input. The over-all size is 9 1/2 inches high by 6 inches in diameter. It is equipped with precision ball bearings, sealed in, which require no lubrication. Vibration and noise are held to a minimum in this improved design. 82

Air-Operated Collet Type Work-Holding Fixture

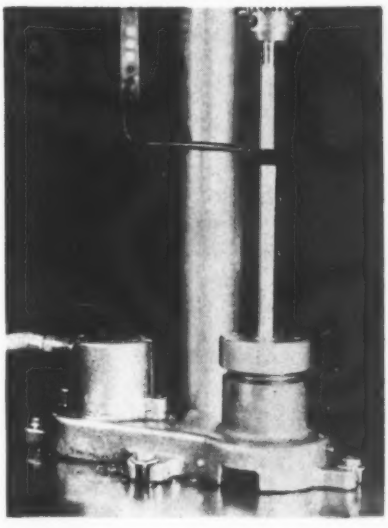
An air-operated, collet type, work-holding fixture is being manufactured by the Red-E-Air Chuck Co., 654 W. Lake St., Chicago, 6, Ill., and distributed nationally by the Cleveland Airtool Co., 4614 Prospect Ave., Cleveland, 3, Ohio. This fixture is designed primarily for the accurate chucking of screw machine parts for second-operation work on drill presses, tapping machines, milling machines, etc., and for drilling, tapping, reaming, threading, chamfering, burring, counterboring, and similar operations. Standard B & S collets are furnished, which chuck work in line with the machine spindle, despite variations in the diameter of the work.

The fixture is operated by a foot-valve, leaving the operator's hands free for loading and unloading. Through a lever connection, the holding pressure at the collet is multiplied relative to the air-line pressure in a ratio of more than 10 to 1. This arrangement provides more than sufficient pressure for holding work under severe machining conditions. The No. 0 size fixture illustrated takes work up to 7/8 inch in diameter. 83

Horizontal Toggle Clamp

A new horizontal type toggle clamp, claimed to be the strongest available for its size and weight, has been placed on the market by Knu-Vise, Inc., 2208 Eighth St., Detroit, 1, Mich. This clamp, known as Model KP 835, has a U-shaped bar which provides for the horizontal positioning of the pressure spindle and permits pieces of varied thicknesses to be clamped without disturbing the original setting.

The clamp is 6 inches in length when closed, and is made of cold-rolled material, cyanide-hardened and cadmium-plated. The spindle is equipped with a Neoprene pressure pad to protect finished surfaces, and has an adjustment range of 1 3/4 inches horizontally within the channel of the U-bar. A clamping pressure of 550 pounds can be applied by simply manipulating the handle. 84

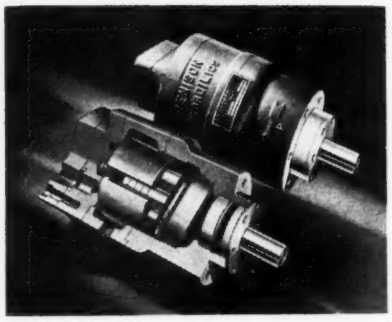


Air-operated Collet Type Work-holding Fixture Made by Red-E-Air Chuck Co.

To obtain additional information on equipment described on this page, see lower part of page 184.

Denison "HydrOilic" Fluid Motors

A new line of fluid motors with floating drive, designed for maximum efficiency wherever rotary oil hydraulic power is required to be transmitted through gears, pulleys, or direct connection, is being placed on the market by the Denison Engineering Co., 1152 Dublin Road, Columbus, 16, Ohio. These fluid motors are built to withstand constant shock loads caused by rapid acceleration, deceleration, sudden stopping and braking, and rapid reversal of equipment rotating at high speeds. The fluid motors deliver rotating power in either direction at an almost infinite number of speeds within their operating ranges. They can be abruptly started, stopped, or reversed, operated intermittently or continuously, or stalled repeatedly without damaging the working parts.



Assembled and Section Views of Denison HydrOilic Fluid Motor

These motors can be mounted in any position—horizontal, vertical, or angular—on the equipment to be driven. Faceplate, foot-plate, and flange type mounting plates are available. The motors are fully self-starting, since the axial piston arrangement eliminates any dead-center position, with the result that, no matter at what position the driving pistons come to rest, the motor will start immediately when oil pressure is applied. 85

Carbide-Tipped Hardened-Shank Reamers

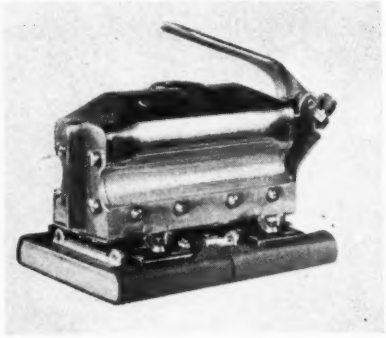
Carbide-tipped reamers of standard sizes, with hardened shanks, are now kept in stock by the Tungsten Carbide Tool Co., 2661 Joy Road, Detroit, 6, Mich. Standardization and mass production have made possible lower prices and quicker delivery of these tools. The standard line of tungsten-carbide reamers comprises both the straight-shank and tapered-shank types in sizes ranging from 1/4 inch to 1 1/2 inches. Up to 1 inch, the reamers come in sizes that increase by steps of 1/32 inch, while above 1 inch, the diameters of the different sizes vary by increments of 1/16 inch.

Carbide-tipped Reamers with Hardened Shanks

Reamers up to 1/2 inch in diameter are provided with four flutes; reamers from 1/2 to 13/16 inch in diameter, inclusive, with six flutes; and all larger sizes with eight flutes. All tips are diamond-ground ready for use, while the outside diameters are held to limits of plus 0 and minus 0.0003 inch. 86

Sundstrand Light-Weight Pneumatic Hand-Sander

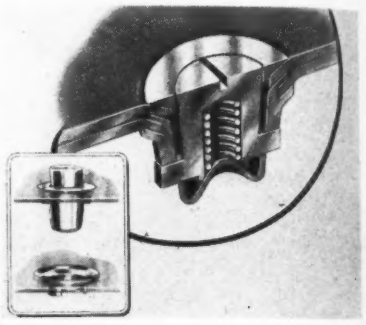
The Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill., has recently added to its line a light-weight non-vibrating "Hi-speed" Model 1000 pneumatic sander. This smaller and lighter machine weighs less than 6 pounds, has a speed of 3500 oscillations per minute, and can be equipped with different types of attachments for sanding large or small, wide or narrow, and flat or curved surfaces on metal, wood, plastics, or composition materials.



Sundstrand Pneumatically Operated Hand-sander

Operation of the machine consists of abrasive pad movements that are started and controlled by a palm-actuated lever fitted to the top of the machine housing. No turning on or off switch is required. When the machine is gripped, the reciprocating action of the pads starts automatically. Upon release, the machine automatically stops.

The opposed pad action and balance of the moving parts eliminate vibration and improve the quality and uniformity of the finished product. Elimination of vibration also serves to reduce fatigue, and thus increases the operator's efficiency. The uniformity of stroke and the high speed of the reciprocating pads are claimed to materially increase the life of the abrasive paper by keeping the surface substantially free from particles of the work. 87

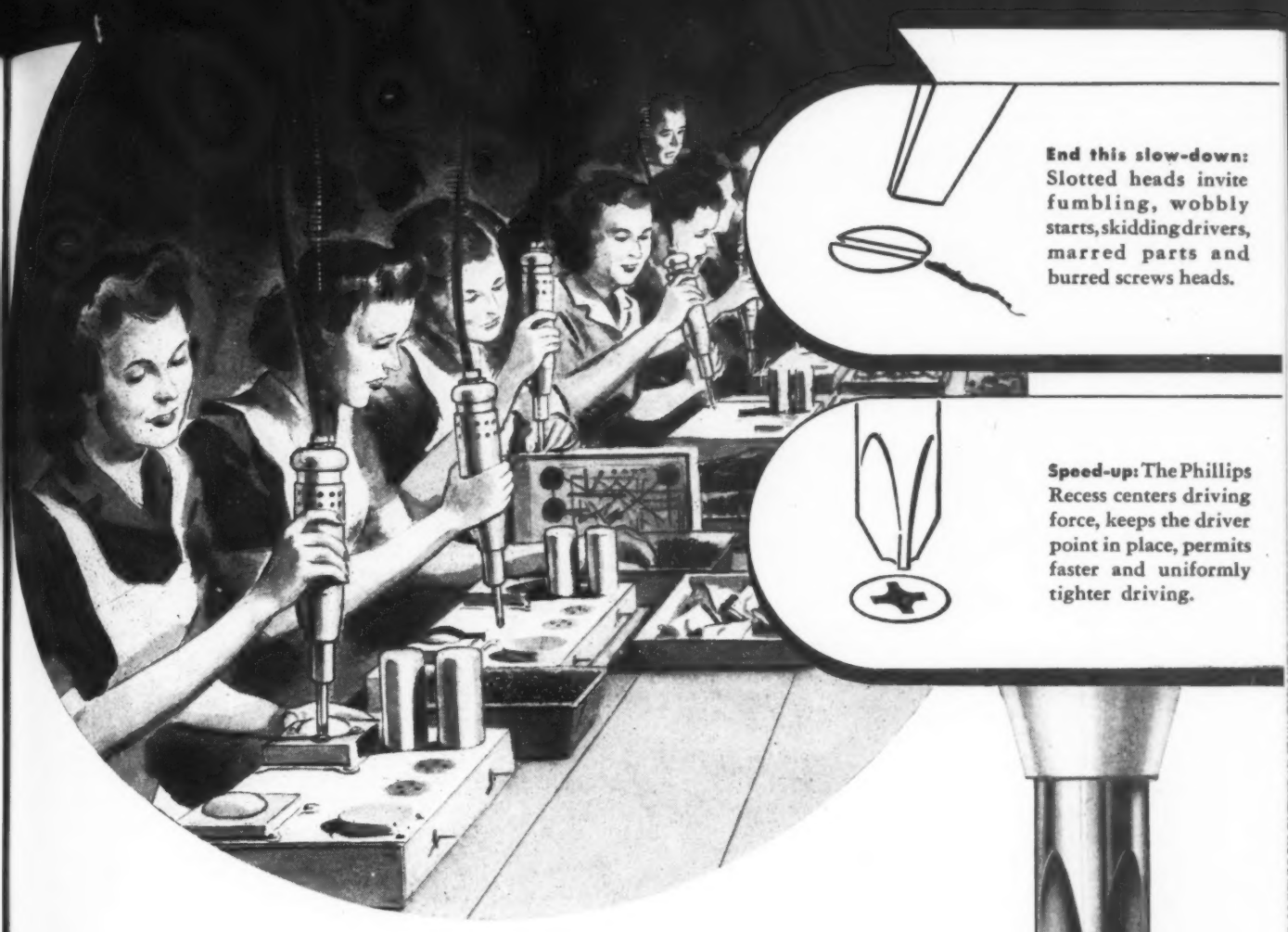


"Simlok" Fastener for Cowlings Developed by the Simmons Machine Tool Corporation

Simlok Fastener for Cowlings and Panels

A new fastening device for aircraft cowlings, inspection plates, panels, and similar uses, known as the "Simlok" fastener, has been developed by the Simmons Machine Tool Corporation, 1600 N. Broadway, Albany, N. Y. As shown in the illustration, the fastening consists of only five parts, four of which comprise the stud member, which is locked semi-permanently in the outer sheet and thus cannot be lost or mislaid during removal of the cowling. The single part, attached to the inner sheet, has slots through which the hardened steel lugs on the stud are passed. The taper design of the stud and

To obtain additional information on equipment described on this page, see lower part of page 184.



End this slow-down: Slotted heads invite fumbling, wobbly starts, skidding drivers, marred parts and burred screws heads.

Speed-up: The Phillips Recess centers driving force, keeps the driver point in place, permits faster and uniformly tighter driving.

Capture EXTRA PRODUCTION with Your Screw Driving Army

PHILLIPS SCREWS DRIVE TWICE AS FAST

Don't just *worry* about lagging production . . . *do something* about it! Boost your output by providing your assembly line with Phillips Screws – the modern speed-screw with the scientifically engineered Recessed Head! The Phillips driver automatically centers in the screw head, utilizes turning power rather than head-on pressure, eliminates the troubles that slow-up driving . . . wobbles, skids, burred screw heads. The result is speedier assembly . . . as much as 50% in some plants.

The skid-proof feature of the Phillips Recess further prevents marred parts and driver-slashed hands. Freed from fear, old timers and newcomers alike can concentrate on fast, faultless driving. Power and spiral drivers can be used to advantage. Switch to Phillips Screws and see how your screw driving army chalks up new assembly records.

Compare the cost of driving Phillips versus slotted head screws. You'll find that it actually costs less to have the many advantages of the Phillips Recess!

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

21 SOURCES

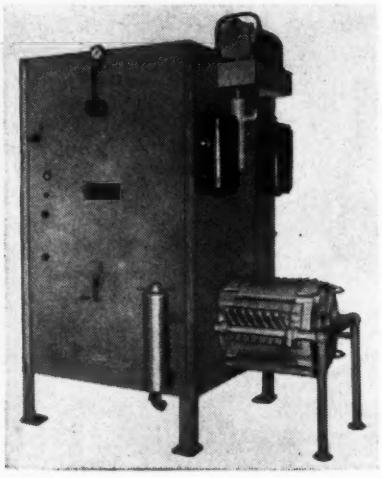
American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

the part into which it fits facilitates assembly of the cowlings.

When unlocked, the stud is automatically held in the ejected position by a spring, as shown in the lower left-hand corner of the illustration. The tension load on the fastening device is not carried by the spring, but by the hardened steel lugs. All wearing parts of the fastener are heat-treated, and the entire assembly is cadmium-plated. The fastening is locked by simply inserting a screwdriver in the slot in the head of the stud, pressing it in flush with the outer sheet, and giving it a quarter turn. The spring serves to hold the stud in the locked position.....88

Hilco Airline Oil Purifier

The Hilliard Corporation, 368 W. Fourth St., Elmira, N. Y., has announced the addition of new units to its line of Hilco Airline oil purifiers. These new purifiers were developed primarily for the purification of aircraft-engine lubricating oil. However, the equipment can also be used for purifying many other types of oil, such as that used in automobiles, tractors, trucks, Diesel engines, gasoline engines, steam engines, turbines, Diesel locomotives, vacuum pumps, hydraulic presses, air compressors, etc. It is also suited for the purification of insulating oils such as are used in transformers and circuit-breakers.

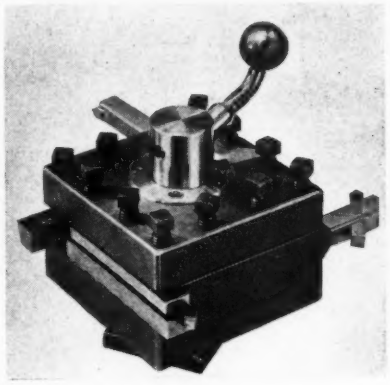


Hilco Airline Oil Purifier

The Hilite compound used in the purifier unit absorbs solids, such as carbon, tarry matter, and abrasives, as well as acids. The unit shown is the Model A-50, which has a capacity of 50 to 65 gallons per hour. Similar units in capacities of 75 to 130 gallons per batch per hour and special units of larger capacity are also available.....89

"Zero-Tol" Toolpost Turret

The Mark Naught Co., 2801 S.E. Milwaukie Ave., Portland, 2, Ore., has brought out a new tool-post turret designated "Zero-Tol," the name being formed by the contraction of the words "zero tolerance." This new turret is of the dual-performance type, with automatic adjustable indexing. It is designed for the heaviest roughing jobs and for work requiring very close tolerances. After the tools have once been set up in the turret, they can be removed and replaced accurately in their indexing positions. One turn of the handle counter-clockwise and back brings the succeeding tool into the operating position. The locking nut and indexing mechanism are entirely enclosed to protect them from dust or metal chips.....90



"Zero-Tol" Toolpost Turret Made by the Mark Naught Co.

* * *

DoAll Exposition of New Products

The Products Exposition and Service Clinic recently held at Des Plaines, Ill., by the DoAll Service Co. of that city presented to the nation-wide representatives of the organization twenty-two new DoAll products. The clinic was sponsored by Continental Machines, Inc., Minneapolis, Minn., and its six associate companies, the DoAll Co., the Savage Tool Co., Contour Saws, Inc., File Bands, Inc., the Alloy Metals Division, and the Speedmaster Co. The exposition had two objectives—to acquaint the representatives with the importance of providing service to industry for the efficient operation of DoAll machines now on war production; and to present new products that will have an importance, not only in the war manufacturing program, but also in post-war production.

* * *

On July 1, 1943, the Office of Price Administration's regulations filled five fat volumes with 11,000,000 words.—*Harry F. Byrd, United States Senator from Virginia.*

Part of the Exhibit at the Recent Meeting of the DoAll Representatives at Des Plaines, Ill.

To obtain additional information on equipment described on this page, see lower part of page 184.

In thousands of war plants, you'll find these tough, long-lived wheels on production lines grinding, burring, smoothing and finishing edges and surfaces on all kinds of products, parts, fixtures and tools, regardless of shape or material.

Custom built for your special work in any grain, grade or size, to meet today's exacting, get-the-job-done demands.

Prompt Delivery..IT'S REALLY TRUE

● Some users may still be skeptical, but we assure you again that we make quick shipments. You see, with WPB approval, we now specialize* on Grinding Wheels and Mounted Wheels and Points up to 3" in diameter only. All larger sizes are out for the duration. Then too, our central location brings most customers within one day's shipping distance.

Write for Catalog today

CHICAGO WHEEL & MFG. COMPANY

America's Headquarters for Small Grinding Wheels, Mounted Wheels and Points

1101 W. Monroe St. Dept. MR, Chicago 7, Illinois

FREE TEST WHEEL—To get acquainted with these fine wheels and our fast service, we'll send one postpaid. Tell us size wheel and material you'd like to try it on.

* Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry.

Send Catalog. Interested in ☐ Grinding Wheels. MR-10
☐ Mounted Wheels ☐ Send Free Wheel. Size.....

Name.....

Address.....

General Electric Industrial Electronics Conference

INDUSTRIAL electronics equipment is playing an important role in our record-breaking war production. According to General Electric officials, speaking at a conference on industrial electronics in Schenectady, N. Y., September 14, this new industrial tool has been directly responsible for saving millions of man- and machine-hours and millions of pounds of scarce materials since the United States entered the war.

There are literally hundreds of electronic devices now available to industry to help do many jobs better than formerly and to do new jobs that could not be done in any other manner. The fields in which industrial electronics principally enter are welding, heat-treating, temperature control, motor control, inspection and counting, speed matching, current and voltage control, measuring and testing, power rectification and frequency changing, industrial X-rays, color matching, and precipitation.

As an indication of the extensive use of electronic devices, L. A. Umansky, assistant manager of the company's Industrial Engineering Division, mentioned that in 1943 not less than 25,000,000,000 kilowatt-hours of electrical energy will pass through electronic devices in the United States alone. As one of the most commonly noted applications, he referred to the contributions of electronic control to electric welding, whereby previously unknown precision, speed, and reliability have been obtained.

In referring to the variety and versatility of electron tubes, W. C. White, engineer of the Electronics Laboratory, mentioned that tubes are now available that will detect and measure currents of less than a billionth of an ampere. At the other extreme, tubes are made to carry thousands of amperes. Similarly, voltages of a millionth of a volt can be detected and amplified, and rectified up to 100,000 volts. Physically, some electron tubes are so small that they can be placed within a thimble; others are taller than a man.

Power conversion and frequency changing were referred to by L. W. Morton of the Industrial Engineering Division. The value of tubes for conversion of current cannot be overestimated in the light of the scarcity of materials during the war period. Great savings have been made by using tubes in place of rotating conversion apparatus. The latter requires, roughly, from 50 to 100 per cent more steel and from 25 to 75 per cent more copper than electronic rectifiers. Because of this, it has been estimated that more than 40,000,000 pounds of steel and 3,750,000 pounds of copper have been saved for other purposes.

Electronic measurements were dealt with by W. C. Hutchins, manager of the Special Products Division of the company. He described a few of the many electronic instruments that perform a wide range of testing and measuring. The electronic vibration velocity meter, for example, has made it possible to measure and analyze vibrations in high-speed machines more accurately than was possible without the use of the electron tube. The part of electronics in induction heating of metals was covered by J. P. Jordan of the Industrial Heating Engineering Division, who particularly emphasized the advantage of this method for the hardening and heat-treating of metals and also for brazing operations.

E. H. Alexander, engineer of the Industrial Control Division, dealt with the subject of electronic control. He emphasized the importance of electronic welding control, and stated that no single industrial electronic equipment had contributed more to the world's production. Automatic timing of industrial processes by means of tubes has become one of the more frequent uses of this equipment. The intensity of light can also be easily controlled in this manner.

The conference ended with a demonstration of the applications of electronics to actual manufacturing work in a number of departments in the company's Schenectady plant.

Tool Engineers to Meet in Indianapolis

The American Society of Tool Engineers will hold its semi-annual meeting at the Claypool and Lincoln Hotels, Indianapolis, Ind., October 10 to 12. The theme of the meeting will be "More Production at Less Cost."

Five technical sessions will be held. Monday forenoon, October 11, the subject of new heat-treating techniques, will be discussed, at which time papers will be read on "Sub-Zero Refrigeration" and "The Tocco Process in the War Effort." Monday afternoon, materials handling and plant lay-out will form the subjects of discussion. The first session on Tuesday, October 12, will deal with gearing. The specific subjects to be discussed will be "Heavy-Duty Gear Design, Manufacture and Application"; "Design and Production of Aircraft Engine Gears"; and the "Making of Gears from Metal Powder."

The Tuesday afternoon session will be devoted to tooling for the inexperienced operator, the titles of the papers being "Hydraulics in Machine Tool Control and Fixture Operation," and "Application of Pneumatic Devices to Tools and Machines." In the evening of the same day, there will be a session on the design and production features of Allison aircraft engines.

Recent Army-Navy "E" Awards

The following companies and their employes have recently received either the Army-Navy "E" Award or a star to add to their Army-Navy "E" pennant in recognition of continued high production:

Aro Equipment Corporation, Bryan, Ohio, plant.

Brown Instrument Co., Division Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

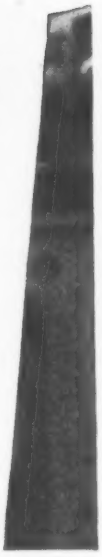
Chicago Wheel & Mfg. Co., Chicago, Ill.

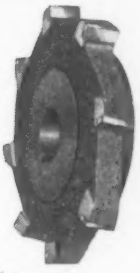
Jarecki Machine & Tool Co., Grand Rapids, Mich.

Pacific Gear & Tool Works, San Francisco, Calif.

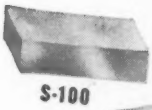
Summerill Tubing Co., Bridgeport, Pa.

STYLE 11





MILLING CUTTER



S-100

S-200

S-300

KENNAMETAL'S GREATER HARDNESS

Assures *Superior Performance*

Efficient machining is the conversion of electric power into chips or cuttings in the least possible time. When the material being machined is steel, a tool of extremely hard composition must be employed to maintain this efficiency at a high level.

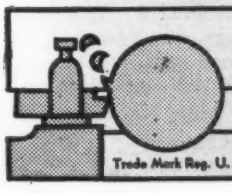
KENNAMETAL steel-cutting carbide tools are preferred to other carbides because their high hardness combined with greater strength enables them to more efficiently turn, face, bore and mill steels up to 550 Brinell.

Grade	Rockwell C	Rockwell A	Strength Transverse Rupture Lbs./Sq. In.
KM	77.6	90.8	305,000
KH	78.6	91.3	275,000
K3H	79.6	91.8	260,000
K4H	80.6	92.3	225,000

KENNAMETAL'S exceedingly high Rockwell rating gives it the ability to "hold size" on long cuts and permits such accurate machining that roughing and finishing can often be accomplished in one operation. Tool wear is greatly reduced, resulting in more finished pieces per tool regrind.

Because of this greater hardness, KENNAMETAL carbide steel-cutting tools will operate at higher speeds and feeds and efficiently machine weld spots, hard scaly surfaces and sandy steel castings with minimum tool consumption.

Improved deliveries are now being made on standard and typical tools, standard tips, lathe centers and grinder centers. Write for your KENNAMETAL catalog and select the tools you need from the wide variety of available types and sizes.



KENNAMETAL Inc.

147 Lloyd Ave., Latrobe, Pa.

Trade Mark Reg. U. S. Pat. Off.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

KENNAMETAL THE All American CARBIDE

News of the Industry

California

W. H. RICHARDSON has been appointed general manager of all divisions of the Timken Roller Bearing Co., Canton, Ohio, on the West Coast

W. H. Richardson, General Manager, West Coast and Orient Divisions, Timken Roller Bearing Co.

and in the Orient. Mr. Richardson has been connected with the company since 1917, serving in various sales capacities until 1929, when he was made manager of the Timken Roller Bearing Service and Sales Co. and vice-president of the Timken Roller Bearing Co. Ltd. of Canada. In 1941, he was made assistant general sales manager of the Timken Roller Bearing Co., and has been devoting much of his time to a study of the development of post-war markets. He will make his headquarters in San Francisco, Calif.

ALVEY-FERGUSON Co., Slauson and Santa Fé Aves., Los Angeles, Calif., has recently been formed for the purpose of manufacturing and selling conveying equipment and metal products cleaning and finishing equipment similar to the products now manufactured by the Alvey-Ferguson Co. of Cincinnati, Ohio. JOHN C. WALTER, president of the Ohio company, is also president of the new company.

HERLUF NIELSEN has been made chief metallurgist in charge of the technical department of the Kinney Aluminum Co., Los Angeles, Calif. Mr. Nielsen was previously director of physical metallurgy at Washington State College.

WAY ENGINEERING Co. announces that it has moved to 3123 W. 8th St., Los Angeles, 5, Calif.

Connecticut

FRANK R. DEDRICK, medical and safety director of the Bullard Co., Bridgeport, Conn., has been nominated for membership on the engineering committee of the Automotive and Machine Shop Section of the National Safety Council. He will serve on the committee for the year 1943-1944. Mr. Dedrick has been connected with the Bullard Co. since 1909.

CLARENCE C. HELMLE has joined the technical staff of the Enthone Co., New Haven, Conn. He will be engaged in plating equipment design, process development, and technical service.

MOORE SPECIAL TOOL CO., INC., 740 Union Ave., Bridgeport, Conn., has taken over the distribution of the Lacey portable die-set machine.

Illinois and Indiana

J. J. TOPOLINSKI has been appointed works manager of Skilsaw, Inc., Chicago, Ill., succeeding L. E. PARKER, vice-president, who has resigned. Mr. Topolinski has been associated with Skilsaw eleven years, and has been superintendent since 1940.

J. J. Topolinski, Newly Appointed Works Manager of Skilsaw, Inc.

SELLSTROM MFG. Co., Chicago, Ill., manufacturer of safety equipment for the eyes and face, is celebrating its twentieth anniversary this year. The company was founded in 1923 in Chicago under the name of Excel Sales Co. Starting from a very small beginning with but four employes, the company has grown to such a size that it now occupies a large portion of a six-story building at 615 N. Aberdeen St., Chicago.

CARBIDE TOOL CO., 816 N. Kostner Ave., Chicago, Ill., announces that the principal division of the company will hereafter be known as the LAKE SHORE TOOL WORKS. This change has been made because the company has decided to devote the major part of its efforts in the future to making high-speed, special-purpose cutting tools, and it believes that the new name will more accurately describe its products and services.

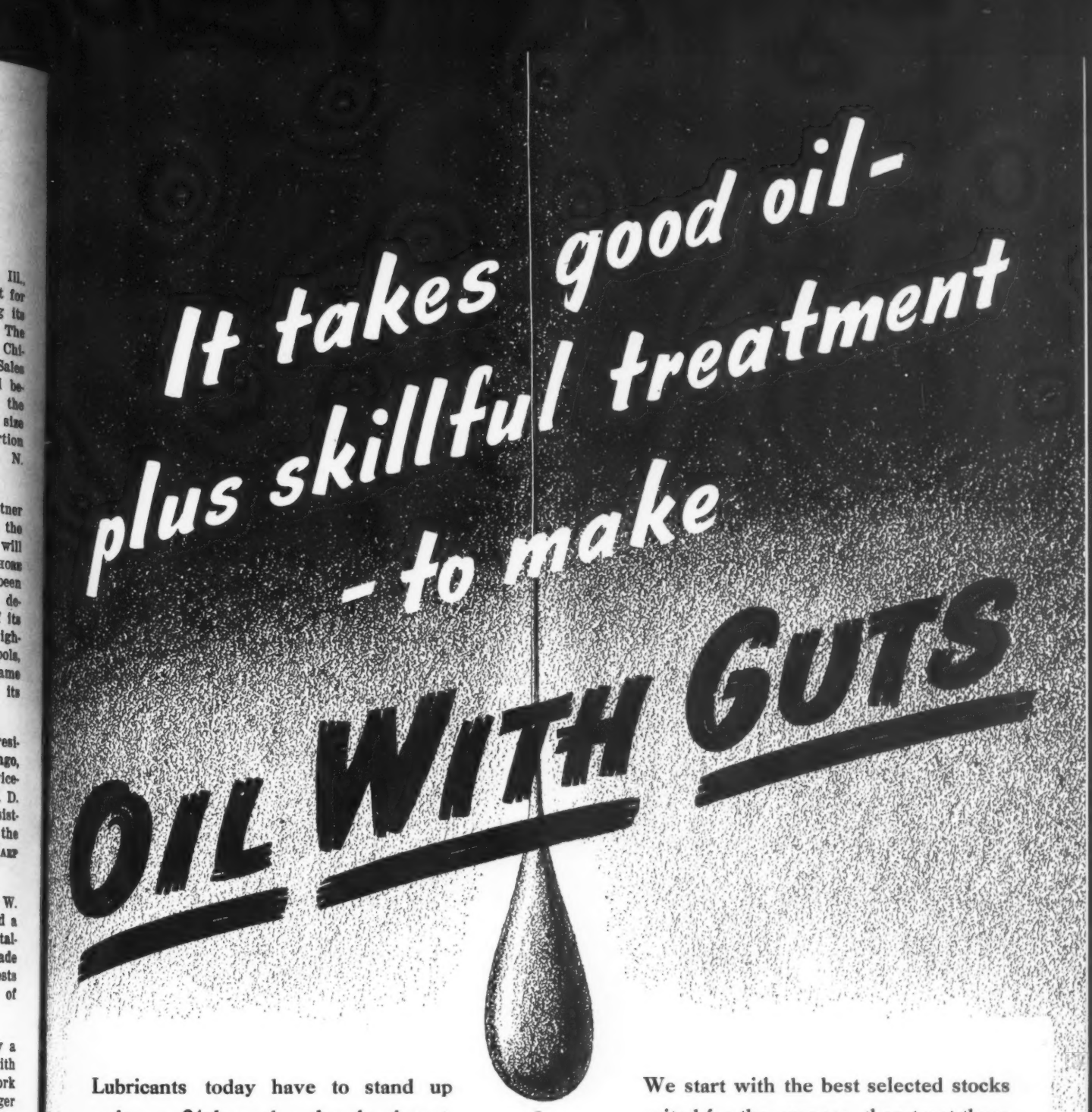
H. T. KESSLER, formerly vice-president of the Tuthill Pump Co., Chicago, Ill., has been made executive vice-president and general manager. W. D. CALDWELL, controller, becomes assistant treasurer, while retaining the duties of controller, and JESS THARP has been made works manager.

INDUSTRIAL ABRASIVES, INC., 3724 W. 38th St., Chicago, Ill., has equipped a new department to manufacture metal-bonded diamond grinding wheels made by a newly developed process. Tests indicate the long-lasting qualities of this new type of wheel.

HARRY T. WORTHINGTON, formerly a sales and production executive with Manning, Maxwell & Moore, New York City, has been made general manager of the Beardsley & Piper Co., Chicago, Ill., manufacturer of foundry equipment.

K. H. HUPPERT Co., manufacturer of electric furnaces, has recently moved into the company's new building at 6830 S. Cottage Grove Ave., Chicago, Ill.

JONATHAN A. NOYES, for the last thirty-one years connected with the Sullivan Machinery Co., Michigan City, Ind., in various capacities, has been elected a vice-president of the American Society of Mechanical Engineers. At present, Mr. Noyes is located at Dallas, Tex., where he is product and division manager for petroleum machinery of the Sullivan Machinery Co. He is a graduate of the Massachusetts Institute of Technology, class of 1912.



Lubricants today have to stand up under a 24-hour-day bombardment. They are the shield between metal surfaces in motion, enabling machines to last longer, perform better, produce more.

To carry today's loads at high speeds, the lubricant cannot be just "any old oil". It should be prescribed by a lubrication specialist, and made by a concern which knows the secrets of modern petroleum reinforcement.

Houghton qualifies both ways—in the oil itself and in the counsel given to help establish sound lubrication practice.

We start with the best selected stocks suited for the purpose, then treat those stocks to enable them to carry loads twice to four times as heavy as the same oils untreated. We treat them also to increase their resistance to leakage—better cohesion, and adhesion to metals. And there are other treatments to prevent sludging, to render them stable under severe conditions, without chemical change.

That's why we say that good oil plus skillful treatment means "oil with guts". Houghton's "fortified" oils are helping war production; may we demonstrate?

E. F. HOUGHTON & CO.

303 W. LEHIGH AVENUE, PHILADELPHIA

CHICAGO • DETROIT • SAN FRANCISCO • TORONTO

Massachusetts

ROBERT H. MCCRACKEN has been appointed manager of combined sales of the Boston office of the Lukens Steel Co. and its subsidiaries, the BY-PRODUCTS STEEL CORPORATION and LUKENWELD, INC., at 131 State St., Boston, 9, Mass. Mr. McCracken was connected for eighteen years previously with the Central Iron and Steel Co., Harrisburg, Pa., and for the last two years served as assistant general sales manager. H. G. AUSTIN, who has been assistant manager of sales for the Boston office of the Lukens Steel Co., has been appointed assistant manager of combined sales. HARRY G. PORCH, manager of sales since 1900 in the Boston, Mass., office of the Lukens Steel Co., retired from active duty on September 1, after forty-eight years of continuous service with the company.

C. P. HOWARD and C. PHILIP CARLSON, of the Rockwood Sprinkler Co., Worcester, Mass., have received the first U. S. Army Ordnance citations to be conferred in New England for their "marked contribution to the vital war production program to conserve critical material and machines." The Rockwood Sprinkler Co., a member of the newly formed Pressed Metal Institute, is manufacturing war materiel for the duration, and the citations were specifically made for breaking a production bottleneck in the manufacture of 20-millimeter steel cartridge cases.

CARPENTER STEEL CO., Reading, Pa., has appointed the AUSTIN-HASTINGS CO., INC., eastern New England distributor for Carpenter tool steels. Stocks of Carpenter matched tool steels will be maintained at Worcester and Cambridge, Mass. The Carpenter warehouse in Hartford, Conn., will continue to serve southern and western New England.

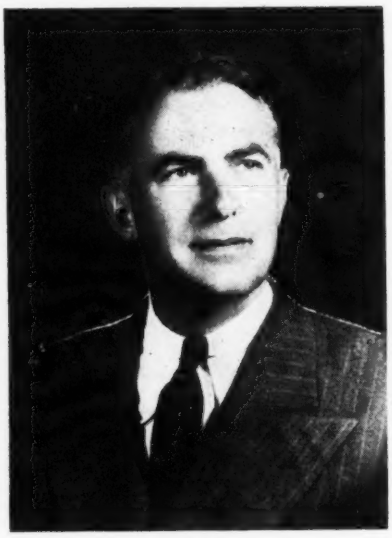
VAN NORMAN MACHINE TOOL CO., Springfield, Mass., announces that the firm name has been changed to VAN NORMAN CO. This change has been made because the company's line of products is no longer confined to machine tools, but includes also automotive service equipment and induction heating equipment, as well as other products associated with the field of electronics.

J. W. BURDICK has been advanced from the post of salesman to the position of assistant district manager of the Springfield, Mass., office of the Allegheny Ludlum Steel Corporation. J. T. PURTELL has been made salesman in the Springfield district. He was formerly assistant manager of orders at the Watervliet, N. Y., plant of the corporation.

TAFT-PEIRCE MFG. CO., Woonsocket, R. I., announces that it has appointed the AUSTIN-HASTINGS CO., INC., 226 Binney St., Cambridge, Mass., machine tool representative for the company throughout New England with the exception of Connecticut.

Michigan

K. R. BEARDSLEE, for the last seven years general sales manager for the Carboloy Company, Detroit, Mich., has been made vice-president in charge of sales. Mr. Beardslee has been associated with the Carboloy Company for



K. R. Beardslee, Recently Appointed Vice-president in Charge of Sales of the Carboloy Company

the last thirteen years, first in the Newark branch office and later as district manager in the Pittsburgh office.

WILLIAM HEIDGERD has been appointed district sales manager of the Follansbee Steel Corporation, Pittsburgh, Pa., for the Michigan territory. District headquarters have been established in the Stevenson Bldg. at Detroit. Mr. Heidgerd was formerly director of purchases for the Parsons Co., Traverse City, Mich.

HYATT ENGINEERING CO., designing engineers, have moved their entire engineering office to new and larger quarters at 504 Architects Bldg., 415 Brainard St., Detroit, 1, Mich. E. J. MURCHISON has been added to the staff in the capacity of chief engineer.

DETROIT REX PRODUCTS CO., Detroit, 27, Mich., manufacturer of degreasers, cleaners, and cleaning compounds, announces that the firm name has been changed to DETREX CORPORATION. No change has been made in ownership, policy, or management.

FOSTER ENGINEERING CO. announces the removal of the company to its new factory at 4200 Woodward Ave., Royal Oak, Mich.

New Jersey

RUDOLPH F. GAGG, assistant to the general manager, Wright Aeronautical Corporation, Paterson, N. J., has been elected a vice-president of the American Society of Mechanical Engineers. Mr. Gagg received a B.S. degree at the University of Colorado in 1923, and later attended the Sheffield Scientific School, Yale University, for two years in a post-graduate course, receiving a degree in mechanical engineering. Since 1930, he has been with the Wright Aeronautical Corporation holding the positions of senior test engineer, experimental engineer, and assistant chief engineer, until he was made assistant to the general manager in 1940.

ELMER C. COOK and FRED J. SCHWEIZER, formerly sales manager and service engineer, respectively, of the American Gas Furnace Co., Elizabeth, N. J., have resigned to form the COOK-SCHWEIZER CO. The new concern will engage in commercial heat-treating, and will be located in Elizabeth, N. J.

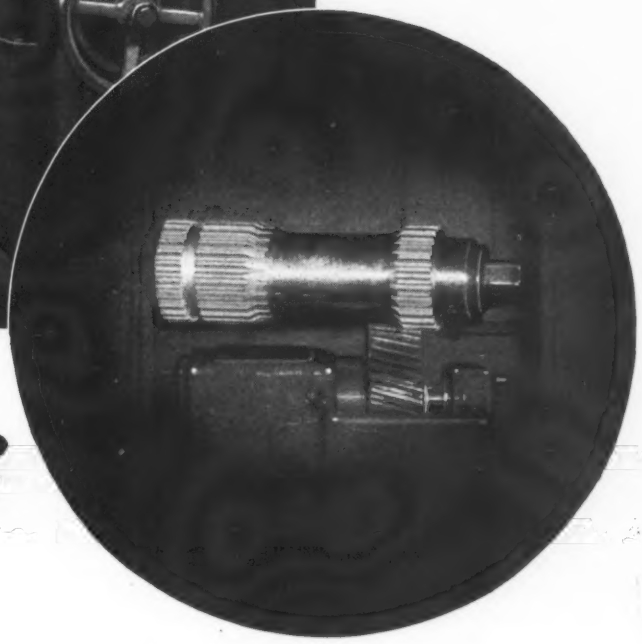
COOPER ALLOY FOUNDRY CO., Hillside, N. J., has recently completed a plant for making centrifugally cast alloy castings for aircraft and other purposes. The new plant has about 17,000 square feet of floor space. The company specializes in corrosion- and heat-resistant alloys.

L & R MFG. CO., manufacturer of precision cleaning machines and cleaning solutions, is now located in a new plant at 577 Elm St., Arlington, N. J., where its manufacturing facilities, offices, and laboratories have been consolidated.

New York

ROTAWINGS, INC., has been formed with AGNEW E. LARSEN as president and JOSEPH S. PECKER as chairman of the board, for the purpose of doing aeronautical research. The concern maintains offices at 1011 Chestnut St., Philadelphia, 7, Pa., and 200 Madison Ave., New York, 16, N. Y. The new organization will devote itself to the licensing and engineering for manufacturers of helicopters and accessories. Both Mr. Larsen and Mr. Pecker have been associated with the autogiro since its inception in this country, Mr. Larsen as chief engineer

..as for Aircraft



Shaved Gears

FOR TANKS

Widely regarded as a "pilot" plant in the production of specialized precision gears for tanks is the Mack Manufacturing Company.

Even though the accuracies and finish required in gears for such vehicles far exeed normal requirements–Mack is doing an outstanding job in producing such gears by mass production methods, employing Michigan gear shaving, gear lapping and gear checking equipment.

Finished on the Michigan 860 rotary machines at Mack are both shaper cut and hobbed gears as well as involute splines.

It makes no difference to a precision gear shaver whether the gear it finishes is for a tank, for a boat or for an aircraft engine.

Ask for the new 32-page Gear Finishing manual GF-43

BUY U.S. BONDS STAMPS

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD . . DETROIT 12, U. S. A.

and president of the Pitcairn-Larsen Autogiro Co., and Mr. Pecker as consulting engineer.

CLAYTON S. SHOEMAKER has been appointed eastern sales manager, and FREDERICK A. KOCH, assistant eastern sales manager of the Dow Chemical Co., Midland, Mich. Mr. Shoemaker

Clayton S. Shoemaker
Eastern Sales Manager
Dow Chemical Co.

Frederick A. Koch, Assistant
Eastern Sales Manager of the
Dow Chemical Co.

has been with the company for several years, and has occupied various sales executive positions. Mr. Koch has been assistant manager of the New York sales office for fifteen years. Both Mr. Shoemaker and Mr. Koch will make their headquarters at the New York City office, 30 Rockefeller Plaza. It has also been announced that ALEXANDER LEITH, JR., has been made manager of the Philadelphia office, and ALFRED A. LAWRENCE manager of the Boston office.

WILLIAM C. CUNTZ has been appointed district manager of the Welding Division of the Metal & Thermit Corporation, 120 Broadway, New York City. Mr. Cuntz will make his headquarters at the corporation's branch office at 1514 North Ave., W., Pittsburgh, Pa. Mr. Cuntz has been connected with this organization since 1936, and has been engaged in sales and service work in connection with thermit welding and Murex electrodes since 1937. The territory under his supervision will include southern New Jersey, Pennsylvania, Ohio, and all the southeastern states, including Kentucky, Tennessee, and Alabama.

T. H. WICKENDEN has been appointed manager of the Development and Research Division of the International Nickel Co., 67 Wall St., New York City, and H. J. FRENCH has been made assistant manager. Mr. Wickenden, who has been assistant manager of the division since 1931, succeeds the late Albion James Wadhams. Mr. French has been in charge of alloy steel development since 1932, and is temporarily serving in the Steel Division of the War Production Board.

WESTCOTT CHUCK CO., Oneida, N. Y., recently made awards for meritorious service to three retired employes of the company—JESSE HARVEY, who had been with the company fifty-two years; ALBERT E. EMMS, fifty-one years; and JOHN J. HOOK, thirty-five years. Each received a gold service pin set with a diamond, as well as a purse of money based on his years of service. Pins were also awarded to other employes who had been with the company for shorter periods.

JOHN S. BARNES CORPORATION, 301 S. Water St., Rockford, Ill., has opened an eastern sales office at 2003 Fisk Bldg., 250 W. 57th St., New York City. E. C. HAWKINS, formerly chief engineer of the LEMAIRE TOOL & MFG. CO. of Detroit, Mich., will have charge of the new office. The company also announces the appointment of HENRY G. HOSS, 4301 Park Ave., Indianapolis, Ind., as sales representative for the company in the state of Indiana.

ALEXANDER KENNEDY, JR., has been appointed assistant to the manager in charge of engineering of the Federal and Marine Divisions of the General Electric Co., Schenectady, N. Y. HOWARD P. BISH has been made assistant to the manager in charge of administrative affairs. Previous to joining the General Electric marine department on his return from World War I, Mr. Kennedy was associated with the induction motor engineering department.

LOUIS G. VOCK and JAMES M. WILSON have been appointed district engineers in the Thermit Department of Metal & Thermit Corpn., 120 Broadway, New York. Mr. Vock will operate from the corporation's branch at 7300 S. Chicago Ave., Chicago, Ill., and Mr. Wilson from the branch at 1514 North Ave., W., Pittsburgh, Pa. Both men have served the corporation for many years as service engineers.

W. S. ROCKWELL CO., 50 Church St., New York City, manufacturer of heat-treating furnaces and blast-gate valves, announces the election of the following officers: C. D. BARNHART, chairman of the board of directors; C. B. KENTNOR, JR., president; J. A. DOYLE, vice-president; H. J. N. VOLTMAN, secretary; and G. A. YAGLE, treasurer.

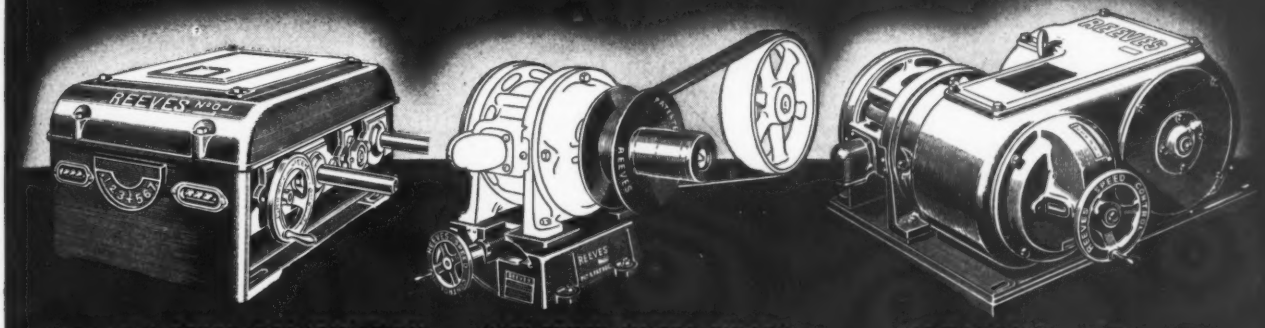
ROBERT L. SHAFFERT (ball and roller bearing clearing service) announces his removal to larger quarters at 501 Fifth Ave., New York, 17, N. Y.

Ohio

ROBERT R. RHODEHAMEL has been made general sales manager of the National Acme Co., Cleveland, Ohio. Mr. Rhodehamel started with the National Acme organization in 1914 as a shop errand boy; at the age of twenty, he became foreman of automatics, and three years later he was made superintendent of the Product Division. During the years in which the company developed specialized divisions for threading tools, airplane wheels and brakes, electrical specialties,

Robert R. Rhodehamel, New
General Sales Manager of
the National Acme Co.

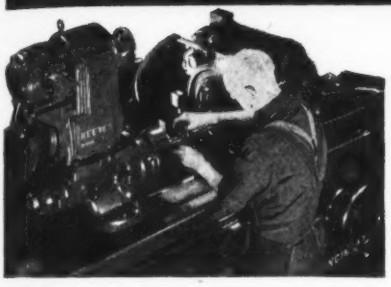
MANPOWER BOOSTERS...



VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over wide range.

VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive.

MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit.



Manpower problems are perplexing you today as never before. Machine operators must be recruited from the ranks of women and from "white collar" men.

Anything that helps these workers get the hang of their new jobs faster, contributes vitally to our war program. REEVES Variable Speed Drives do this by enabling operators to adjust machine speeds to their own skills, to different sizes and kinds of parts and materials, quickly and accurately without stopping the machine.

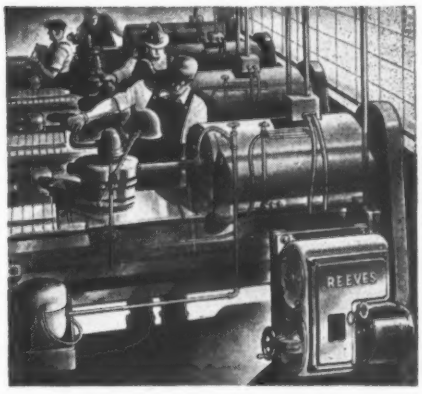
REEVES Speed Control also insures greater precision and enables skilled operators to turn out more work—in many instances doubles productive capacities of men and machines.

Many Designs and Models

The three basic REEVES units shown above are made in a wide range of designs and sizes. One of these units can be quickly installed on any type or make of production machine to provide "stepless" speed adjustability. Full description of REEVES units and their use in more than 25,000 plants throughout industry is contained in 124-page Catalog-Manual M-419. Send for it.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering



GUN PART PRODUCTION INCREASED 25%

—in this Detroit machine shop, without extra machines, extra labor or extra floor space—when REEVES Variable Speed Drives were installed.

REEVES *Accurate Variable* SPEED CONTROL

Acme-Gridley multiple-spindle bar automatics, and chucking automatics, Mr. Rhodehamel acquired an intimate knowledge of each, and in 1941, he was placed in charge of the Planning Department, serving all five divisions.

G. V. KULLGREN has joined the Akron, Ohio, staff of the Farrel-Birmingham Co., Inc., Ansonia, Conn. Mr. Kullgren was previously connected with the General Electric Co., Schenectady, N. Y., in that company's Industrial Engineering Division, specializing on the application of electrical equipment in the rubber industry. For several months, he represented the Office of Rubber Director, War Production Board, as electrical consultant on the U.S.S.R. tire plant project, which involved the design and delivery of a complete tire plant to Russia.

G. V. Kullgren, Now Connected with Akron Office of Farrel-Birmingham Co.

OHIO CRANKSHAFT CO., Cleveland, Ohio, manufacturer of automotive, aviation, and Diesel engine crankshafts, and originator of the Tocco process of induction heating, has appointed RUDEL MACHINERY, INC., New York City, and the SWIND MACHINERY Co., Philadelphia, Pa., machine tool distributors for the company.

WILLIAM J. CONLEY, formerly chairman of the Engineering Department of the University of Rochester, Rochester, N. Y., has been appointed consulting engineer of the Lincoln Electric Co., Cleveland, Ohio, manufacturer of arc-welding equipment. Mr. Conley will act as a welding consultant for various industries, handling problems on mechanical and structural design utilizing welding, as well as metallurgical problems involving welding processes. He will also have charge of the company's welding educational activities, consisting of courses in welding engineering and design, as well as lectures on welding before technical societies and industrial groups.

William J. Conley, Recently Appointed Consulting Engineer of Lincoln Electric Co.

R. C. GRIFFITH has become affiliated with the Denison Engineering Co., Columbus, Ohio, designer and manufacturer of oil-hydraulic machinery and equipment. He will serve the company as manager of engineering and research, and will collaborate with its marketing division. Mr. Griffith has had wide experience in oil-hydraulics, and was associated from 1934 until the present with Vickers, Inc.

R. C. Griffith, Manager of Engineering and Research Denison Engineering Co.

DELOS M. PALMER, dean of engineering at the University of Toledo since 1934, has been appointed plant engineer at the American Propeller Corporation, subsidiary of the Aviation Corporation of Toledo, Ohio, manufacturer of hollow steel propeller plates for aircraft.

Pennsylvania

DAVID W. R. MORGAN, works manager of the Steam Division, Westinghouse Electric & Mfg. Co., Philadelphia, Pa., has been elected a vice-president of the American Society of Mechanical Engineers. Mr. Morgan is a graduate of Ohio Northern University, class of 1913, and has been with the Westinghouse organization ever since his graduation, having successively held many executive positions until he was appointed works manager of the Steam Division last April.

ROBERT W. OWEN has joined the staff of the Quaker Chemical Products Corporation, Conshohocken, Pa., in the capacity of metal process engineer, covering eastern Pennsylvania, Maryland, and Delaware. Mr. Owen received his metallurgical training at the Carnegie Institute of Technology. He has had twelve years of experience in the steel manufacturing industry, including the fabrication of airplane parts and armament production

GEORGE M. GILLEN, formerly in charge of advertising and sales promotion for the Lukens Steel Co., Coatesville, Pa., has been appointed assistant manager of combined sales for the company and its subsidiaries.

Wisconsin

R. J. MINSHALL has been appointed president of the McCulloch Engineering Corporation, Milwaukee, Wis., manufacturer of superchargers, to take the place of ROBERT MCCULLOCH, founder of the company, who is resigning to head a new organization known as the MCCULLOCH AIRCRAFT CO. JAMES P. STEWART has been made assistant general manager of the McCulloch Engineering Corporation. Mr. McCulloch will remain a member of the board of directors, and will serve as a consultant to the firm.

TRICO FUSE MFG. CO., Milwaukee, Wis., has appointed the SOUTHEAST ENGINEERING CO., 2056 Post St., Jacksonville, 1, Fla., representative in the states of Florida, Georgia, and Alabama for the line of fuses, clamps for fuse clips, oilers, and accessories made by this company.

CHARLES A. PETRI has been appointed advertising manager of the Falk Corporation, Milwaukee, Wis., manufac-

Quaker Research now makes it practical to

CLEAN AND RUSTPROOF

in one operation!

LONG BEFORE THE URGENCY of war production and manpower shortages gave such added importance to the elimination of production operations wherever possible, we at Quaker Chemical were at work on the development of a water-emulsifiable solvent which would not only provide thorough metal cleaning, but would also afford effective temporary rustproofing . . . all in one operation!

Beginning with the idea of displacing alkali cleaning and straight solvent degreasing with a new process, our Research Laboratory tackled the problem of harnessing the effectiveness of solvents with water and mechanical power.

During the past ten years this development work has progressed—both in the laboratory and in actual production usage—until, today, there is available a complete line of QUAKER QUASOLS . . . water emulsifiable solvents in liquid form.

COMBINES SOLVENT & MECHANICAL ACTION

Used in the proportion of 1 gallon of QUASOL to approximately 50 gallons of water, in washing machines run at no higher than 140°F., the solution removes greases, dirt, soaps and inert materials from metal parts by a combination of solvent, thermal and chemical action.

Dirt and oil float to the surface of the solution and are easily removed in the skimming tank of the washing machine. In this way the cleaning solution is always kept free of grease and, with occasional additions to compensate for drag-out, will continue to provide good results almost indefinitely.

LEAVES RUST-PREVENTING FILM

In addition to its effective cleaning properties, the emulsifiable solvent leaves on the work an imperceptible coating that prevents rust for a period of from two weeks to six months (depending upon the concentration used). Thus it protects from rusting any metal parts held over for short periods on conveyor lines or in stock.

So, if you are interested in a metal cleaning process which provides rapid, thorough cleaning at low cost . . . leaves an excellent surface for finishing and coating operations . . . with no alkali film on the work . . . and no rust—we suggest that you call in a *Quaker Process Engineer*. Let him analyze your requirements and recommend the correct type of QUAKER QUASOL to produce the results you want.

QUAKER PROCESS ENGINEER KNOWS YOUR PRODUCTION PROBLEMS

You'll find the Quaker Process Engineer a graduate engineer or chemist . . . intimately acquainted with your production problems through years of personal experience . . . and thoroughly trained in the application of Quaker's many new type products for the metal working field. He'll gladly share with you his knowledge of metal cleaning, rustproofing, cutting, grinding, and almost any other process in metal manufacture—whether served by Quaker Chemical products or not. Simply write, wire or phone—

QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

Other Plants in CHICAGO and DETROIT . . . . Warehouse Stocks in Principal Industrial Centers

turer of herringbone and single helical gears, speed reducers, and flexible couplings. Mr. Petri replaces RALPH H. DEIHL, who has joined the Army Air Force.

P. S. JONES has been appointed general sales manager for Cutler-Hammer, Inc., Milwaukee, Wis., manufacturer of motor control apparatus. Mr. Jones has been in charge of the New York sales territory for fourteen years.

Coming Events

OCTOBER 5-7—NATIONAL SAFETY CONGRESS in Chicago, Ill. For further information, address National Safety Council, 20 N. Wacker Drive, Chicago.

OCTOBER 10-12—Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS in Indianapolis, Ind., with headquarters at Hotels Claypool and Lincoln. Adrian L. Potter, executive secretary, 2567 W. Grand Blvd., Detroit, 8, Mich.

OCTOBER 18-21—Twenty-fourth annual meeting of the AMERICAN WELDING SOCIETY at the Hotel Morrison, Chicago, Ill. For further information, address the American Welding Society, 33 W. 39th St., New York City.

OCTOBER 18-22 — Annual meeting of the AMERICAN SOCIETY FOR METALS at the Palmer House, Chicago, Ill., in conjunction with the twenty-fifth annual National Metal Congress. W. H. Eisenman, national secretary, American Society for Metals, 7301 Euclid Ave., Cleveland, 3, Ohio.

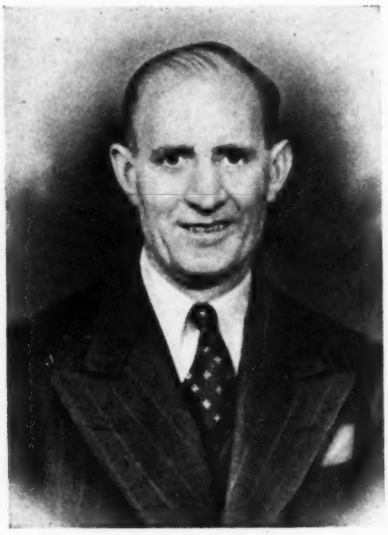
OCTOBER 25-27—Fall meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Edgewater Beach Hotel, Chicago, Ill. Newbold C. Goin, executive secretary, Empire Bldg., Pittsburgh, Pa.

NOVEMBER 29-DECEMBER 3 — Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Pennsylvania, New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 6-11—NINETEENTH EXPOSITION OF CHEMICAL INDUSTRIES at the Madison Square Garden, New York City. For further information, address International Exposition Co., 480 Lexington Ave., New York City.

JANUARY 10-14, 1944 — Annual meeting and engineering display of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

Obituaries



Charles D. Hogan

Charles Driscoll Hogan, secretary of the United States Electrical Tool Co., Cincinnati, Ohio, died on July 20 at the age of forty-eight. Mr. Hogan was born in Kentucky, and attended the St. Xavier High School and University. He was a veteran of World War I, retiring with the rank of Lieutenant. Mr. Hogan became associated with the United States Electrical Tool Co. in 1920, and was elected to the board of directors and made secretary in 1922. He was also a member of the board of directors of the Cincinnati Bank and Trust Co.

Long active in St. Xavier University affairs, Mr. Hogan helped install the accounting courses taught in the commercial department. He was very much interested in the electrical tool industry, and was instrumental in effecting many of the practices now in use by most leading concerns. He is survived by his widow and three sons.

A. J. Wadhams

Albion James Wadhams, of Dongan Hills, Staten Island, N. Y., a vice-president and manager of the Development and Research Division of the International Nickel Co., New York, died at his summer home in Elizabethtown, N. Y., on August 22 of a heart attack at the age of sixty-eight years. Mr. Wadhams was the son of the late Rear Admiral Albion V. Wadhams of the United States Navy. He was born at Annapolis, Md., and was graduated from the United States Naval Academy in 1895. Mr. Wadhams served as an ensign and later as a lieutenant, junior grade, in the United States Navy from 1895 to 1901. He had been connected with the International Nickel Co. and its predecessor companies since 1901. He was made manager of the company's Development and Research Division in New York in April, 1922, and had been a vice-president of the company since October, 1935. Under his leadership many of the wide applications of nickel and its alloys were developed.

Mr. Wadhams was a member of the American Iron and Steel Institute, American Institute of Mining and Metallurgical Engineers, American Society of Naval Engineers, American Society for Metals, the Mining and Metallurgical Society of America, and many other associations. He is survived by two daughters and two sons.

Raymond S. Dean

Raymond S. Dean, president of the R. S. Dean Co., Chicago, Ill., manufacturer of machine tools, died on August 22 at the age of sixty-one.

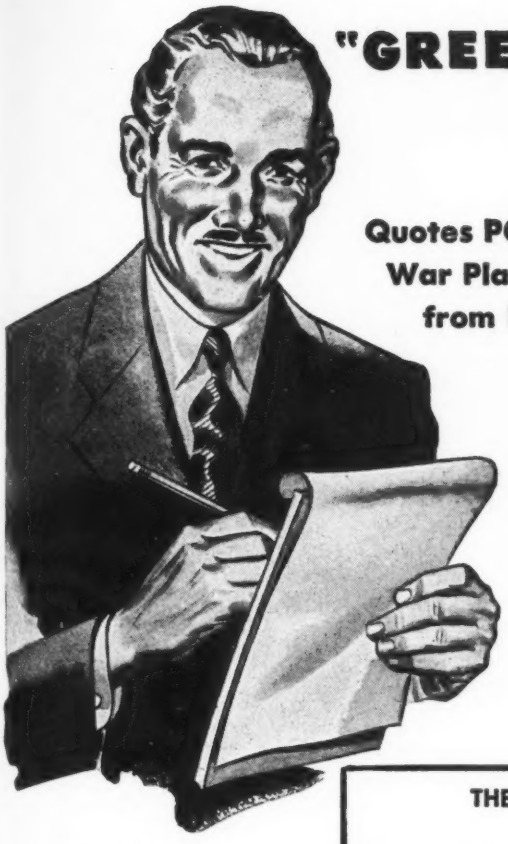
Mr. Dean had been prominent in machine tool and railway equipment circles for many years, not only in Chicago and the Middle West, but throughout the country. He was educated at the University of Minnesota, from which he graduated with the degree of Mechanical Engineer. He went to Chicago in 1908, and entered the employ of Manning, Maxwell & Moore. Eventually he became general manager of that company's Chicago Division, and remained with them until they discontinued their machinery business in 1933, when he formed his own company, which he operated most successfully up to the time of his death.

Mr. Dean was a member of the American Society of Mechanical Engineers. He is survived by his wife, a daughter, and a son, Captain John Irwin Dean, U. S. Army Air Corps.

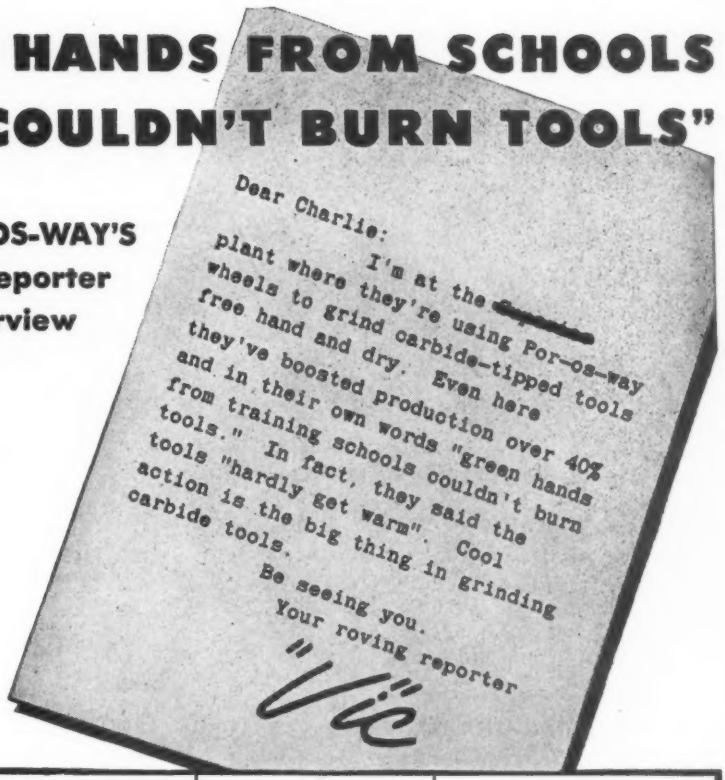
WILLIAM O. INGLE, for many years vice-president and treasurer of the Consolidated Machine Tool Corporation, Rochester, N. Y., died on September 2, after a short illness, at the age of sixty-eight years. Mr. Ingle had a wide acquaintance in the machine tool field. In addition, he was nationally known for his work in connection with the Rose Society, and the roses and other flowers grown by him brought him wide acclaim wherever exhibited.

HUGH A. TODD died on July 31, following an illness of several months. Mr. Todd was one of the pioneers in the Hanson-Van Winkle-Munning Co., Matawan, N. J., and in the plating industry of the East. More than forty years of his life had been spent in the industry, starting with the predecessors of the present Hanson-Van Winkle-Munning Co. For many years he had been New York State representative for this company, with headquarters at Syracuse.

"GREEN HANDS FROM SCHOOLS COULDN'T BURN TOOLS"



Quotes POR-OS-WAY'S War Plant Reporter from Interview



Dear Charlie:

I'm at the [redacted] plant where they're using Por-os-way wheels to grind carbide-tipped tools free hand and dry. Even here they've boosted production over 40% and in their own words "green hands from training schools couldn't burn tools." In fact, they said the tools "hardly get warm". Cool action is the big thing in grinding carbide tools.

Be seeing you.

Your roving reporter

"Vic"

THE RECORD	POR-OS-WAY WHEEL	FORMER WHEEL
Number tools per hour per man	37	26
Number of dressings required	NONE	Every 2 hours
Pieces per wheel	888	520
Stock to be removed	.000"—.250"	same
Wheel life	24 hours	20 hours
Depth of cut	.002"—.010"	Tools burned when jammed into wheel
Number of passes required	12	48
Amount of rejects	0	50 per day (scrapped)
Increase in production	42.3%	

THE JOB: Grinding free hand and dry on Excello Tool Grinder carbide-tipped tools 1" x 1" x 6", for turning airplane struts, shaping airplane carburetors, shaping and turning gun turrets for planes.

THE WHEEL: Por-os-way 10" x 2" x 2" C54KV3

All facts and figures given are taken from an actual field survey made by a Por-os-way correspondent

WRITE, *for complete booklet "Facts About Por-os-way". The address is 428 Wheatland Street, Phoenixville, Pennsylvania.*

2 TO 5 TIMES MORE WAR PRODUCTION PER MAN PER MACHINE

POR-OS-WAY*

a new RADIAC* PRODUCT

A. P. DE SANNO & SON, INC.
NEW YORK, CHICAGO, PITTSBURGH, CLEVELAND, DETROIT, LOS ANGELES

PHOENIXVILLE, PENNA.
Western Gateway to VALLEY FORGE

*T. M. Reg. U. S. Pat. Off.

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